MITS MOVING TO EXPANDED FACILITY

ALTAIR CONVENTION

by David Bunnell

By the end of January, 1976, it is hoped that MITS will be in its new facility near the Albuquerque Airport. Internal construction has been in progress for several weeks, and plans call for moving the production department before Christmas. Administrative departments will move during January.

In connection with this move, there will be a combined open-house, World Altair Computer Convention, tentatively scheduled for March, 1976. All Altair owners will be invited to attend this convention.

While formal plans for this convention have not been finalized, an outline of this event calls for a weekend of seminars and demonstrations. The seminars will be conducted by MITS engineers and software writers and will cover a wide range of topics of interest to Altair users.

Hobby clubs and individual Altair owners are asked to bring their Altairs to Albuquerque for demonstration purposes. Prizes worth several thousand dollars will be awarded to the best demonstrations in each of an undetermined number of catagories. (We will be looking for unique applications as well as well-developed traditional applications.)

Since the new MITS plant is located close to the Albuquerque Airport, it will be very convenient for out-of-town Altair users to attend the convention. Hotel reservations can be made at the Albuquerque Airport Marina Hotel across the street from the terminal building, and from there to the factory it is just a short walk.

Once a definite time table has been established for the first WACC (World Altair Computer Convention), all Altair owners will receive a schedule of events and a personal invitation. Attendance to the convention will be free, and in addition to prizes for the best demonstrations, MITS will provide door prizes and at least one free luncheon.

People who have suggestions for this conference are asked to address their letters to: WACC/MITS
2450 Alamo SE
Albuquerque, NM
87106
Attention:
David Bunnell

With the help of the thousands of Altair users, it is hoped that this convention will become one of the most exciting computer conventions in the industry and that it will become an annual event.

BYTE Sponsors ACR Standards Meeting

Users and manufacturers of audio cassette data recording hardware attended a symposium sponsored by BYTE magazine in Kansas City, Missouri on November 7th and 8th, 1975. The purpose of the meeting was to investigate the various methods of recording data on audio tape and to make a recommendation on the method that would meet the requirements of a low cost, reliable system for interchange of tapes.

Those in attendance included representatives of BYTE magazine, Popular Electronics, MITS, Processor Technology, SWTP, Godbout, The Computer Hobbyist, Pronetics, LGC and Sphere.

The first portion of the meeting was concerned with the minimum requirements of the cassette recorder. It was found that speed tolerance was the biggest variable, with speed variance as large as ±10% possible. Minimum frequency response was set at 500Hz to 3KHz ±3db bandwidth, which is easily attained by most low cost cassette recorders. Other parameters such as start/stop time, remote control and tape characteristics were discussed. It was agreed that the standard should include provision for remote start/stop of the tape recorder, and that low noise audio tape (not bargain pack tapes) should be used.

The next part of the meeting concerned the bit format for recording data. The format decided upon was a UART style, 11-bit word to be recorded at 300 bits per second (300 baud). The 11-bit word consists of a start bit (logic Ø), eight data bits, and at least two stop bits (logic 1).

The rest of the meeting was spent primarily on discussion of modulation techniques. Of the methods presented, there were three main groups. One was pulse modulation (The Computer Hobbyist, Tarbell), which has the advantage of high data density and data rate, but the disadvantage of more complex hardware. A second type of modulation considered was the HIT system (Processor Technology, Popular Electronics). It was decided to be too software dependent and possibly amplitude sensitive. The last group of techniques discussed was frequency modulation, including the 103 type (MITS, LGC) and the Lancaster method (SWTP, Pronetics). Frequency modulation has the advantage of somewhat simpler hardware, without being software dependent. The meeting concluded with an agreement to investigate the Lancaster method as the possible modulation standard for hobbyist and user interchange. (The Lancaster method uses 2400Hz = logic 1, and 1200Hz = logic Ø with the advantage of being synchronous with UART clock inputs.)

COMPUTER NOTES

November/December, 1975

Volume One Issue Six

A PUBLICATION OF THE ALTAIR USERS GROUP

Across the Editor's Desk

by David Bunnell

As I recall, the last issue of Computer Notes was the October issue and you got it around November 11. Right?

This issue of Computer Notes should logically be the November issue, however, if you get it before 1976, the December issue won't arrive until February.

Therefore, this issue of Computer Notes is the Holiday Issue.

Now, that should make a lot of sense.

However, doesn't that mean that people who paid $30 to be members of the Altair Users Group will get one less issue of Computer Notes before their subscription runs out? No.

Effective upon the arrival of this issue, you automatically have a one-year subscription. Even if you subscribed back in July, your subscription now begins with the coming January issue (we've got our fingers crossed).

Hopefully, we will learn to be more punctual with this publication.

I think you'll find our Holiday Issue well worth the wait. Included are two four-page inserts from Byte Magazine and Creative Computing. These inserts were prepared entirely by the respective staffs, as was the PCC insert in October's C/N, and I hope they give you an idea about what these two publications are about.

Creative Computing is published by David H. Ahl, who in my opinion, is the best writer in the "popular" computing field. It is aimed primarily at the educational market.

Byte Magazine, which I reviewed in September's C/N, is aimed at the hobby market. There have been recent changes at Byte and I see these changes as resulting in better editorial content.

Both publications are excellent and since they have completely different editorial slants, I would recommend that the serious "computer freak" subscribe to both.

Another magazine trying to make it on a national scale is Interface, which is published by the Southern California Computer Society. They have a long way to go if they want to compete effectively with Byte and Creative Computing, but I understand their first issue is going like hotcakes. This issue features the two Altair computers on the cover in a stunning painting by Kim Behm (the artist who drew the "Created by Man" illustration). A list of articles includes: "Toward the design of a Micro-operating System," "Teleprinter Maintenance/Repair/Preventative Maintenance," "Altair Switch Memory," "1+1=10?" and "Soup Up Your T.V. Typewriter."

Enjoy this issue of Computer Notes, and have a happy holiday.

LOCAL USERS GROUPS

Atlanta Area Microcomputer Hobbyist Club
Jim Dunion, President
421 Ridgecrest Rd.
Atlanta, GA 30307
(404) 373-8990
Meetings are held the last Wed. of each month, 7:30 p.m., at The Calhoun Co.
6000 Peach Tree Rd.
Atlanta, GA

Computer Hobbyist Group of North Texas
Bill Fuller
(214) 641-2909
Neil Ferguson
(817) 461-2867
Lannie Walker
(817) 244-1013

The Amateur Computer Group of New Jersey
Sol Libes
(201) 889-2000 (day)
277-2063 (eve)
George Fischer
(212) 351-1751

29 Palms California Area Group has changed the contact phone number and address to:
Sgt. Wesley Isgrigg
74055 Casita Dr.
29 Palms, CA 92277
(714) 367-6996

Homebrew Computer Club
Robert Reilling, Editor
193 Thompson Square
Mountain View, CA 94043

HP-65 Users Club
% Richard J. Nelson
2541 W. Camden Place
Santa Ana, CA 92704

UCLA Computer Club
3514 Boelter Hall
UCLA
Los Angeles, CA 90024

San Diego Club
% Gary Mitchell
Box 35
Chula Vista, CA 92012

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ALTAIR SERVICE DEPT.

Barbara Sims

New Coding Form

The Users Group Library has a new Coding Form for program submission that is much more efficient than our old form. A sample copy of the new form is enclosed -- it consists of a cover sheet (to give pertinent information about the program) plus an additional sheet of program listing space. Coding Forms are purchased from MITS in batches of 50. When you order the new Coding Forms, please specify how many cover sheets you want included in that batch. (One cover sheet for each program to be submitted.) If you still have copies of the old form, feel free to use them up before ordering the new one.

Programs submitted to the Users Group Library become available to other members much sooner when our coding form is used. The entry rules for the Software Library are as follows; your cooperation in following these rules will be greatly appreciated.

In order that programs can be reproduced for distribution to other Altair owners, they should be typewritten using a ribbon that produces fairly dark type. It is desirable that assembly language and machine language programs be submitted on official Coding Forms or copies of such forms. Coding Forms are available from MITS at $2.00 per 50 to cover printing, postage and handling.

All entries should be on 8 1/2" x 11" white paper. Teletype printouts and Xerox copies are not acceptable.

C/N Delivery Dates

I've had quite a few letters and calls regarding the delivery of Computer Notes. Perhaps it will help if I outline exactly how we mail Computer Notes to different areas:

I. Bulk Mail
  A. Any address with a zip code
    1. United States
    2. APO
    3. FPO

II. Third Class Mail
  A. Canada
  B. Mexico

III. Air Overseas Mail (AO)
  A. Countries overseas

—continued page 5—

Ramblings from Ed Roberts

by H. Edward Roberts,
President, MITS

This is a continuation of my random ramblings concerning the small computer industry, the Altair and MITS. If you have any comments on any or all of these subjects, please write me.

PROBLEMS:

The 4K memory cards are still in a heavy back order situation. The majority of the 4060-2 (4K RAM chips) we have received in the last few months have been diverted to replace the 2604's which were shipped in August. There are now two shifts operating in the Repair Department in order to eliminate this problem. If you have a new order for 4K memories or if you have a 4K board at MITS for repair, please bear with us for the next few weeks.

PHILOSOPHY:

There are a number of questions raised each month concerning the Altair design philosophy. Therefore, starting with this issue I will specifically discuss the most common ones.

1) FRONT PANEL READY: The front panel ready provides an active pullup to the system ready line. Therefore, in the run mode if a bus card pulls the ready line low it must fight the front panel pullup, this is an intentional design and does not create any problems. (Incidentally, a check of the Signetic data manual on the 8797 will show that this is an acceptable condition.) Nevertheless, if you are concerned about this, move the PRDY line to the XRDY line on the system bus wiring from the front panel. That is, move the wire from pin 72 to pin 3 coming from the front panel harness. The XRDY was designed into the system to allow for a simplified DMA which is no longer used by MITS. One mod which has been suggested is move the PRDY line on each card to pin 3 on the card, don't do it. This will cause major conflicts in the system if additional peripherals are added. Some of them are looking for a PRDY from other system cards. If you are using a non-Altair card that uses the ready line, make sure it is connected to PRDY and not XRDY. For that matter, don't use any modification in your system if it doesn't appear in Computer Notes or another MITS publication.

2) POWER SUPPLY: There have been a number of questions raised concerning the power supply used in the Altair. The basic Altair is shipped with a transformer which is rated at 8V and 8 amp. It turns out that in practice if the current load exceeds 3-4 amps (6-8 Altair cards) the unregulated bus voltage drops to the point where local regulation by the 7805 is marginal. But if you have a system which contains 6 or more MITS cards, we will provide you with a higher voltage transformer at no cost. Due to the heavy 5 volt current requirement of some of the 4K static memory cards (discussed in previous issue) you may run out of voltage with as few as 4 cards in the system. The rectifier in the power supply is rated at 10 amp. Which is 20% over the maximum current required by a fully expanded Altair using MITS cards, i.e., .5 amp average per card and 16 cards. The higher voltage transformer should not be used in small systems, i.e., under 5 cards, because it places an unacceptably heavy thermal load on the 7805's.

Another point raised about the power supply is why didn't we use the lower cost single regulator for the whole system, i.e., not use card regulation. There are two primary reasons: (a) the on card regulation significantly improves system noise immunity (b) and most important a castrophic failure in a single regulator system could destroy literally thousands of dollars worth of components.

3) CARDS: There are two comments raised concerning the DC cards used in the Altair. Some cards in the earlier Altairs did not have gold fingers, of course all Altair cards produced recently have gold fingers. Contrary to popular opinion the gold has more esthetic value than practical value. If you have an early Altair board which doesn't have gold fingers, effective immediately you have a 5 year warranty on the fingers.

A valid criticism that was made concerning early Altairs was related to the 1/16" thick motherboard. While this motherboard didn't create an electrical problem, it wasn't rigid enough to support the card guides properly, in a word it was sloppy. Of course, all the later Altairs have 1/8" motherboards. If you have an early Altair and if you are willing to remove the edge connectors from your mother card, let me know and we will send you a new 1/8" card free!

Next month I will discuss other commonly asked questions or criticism.

PROCESSOR COMPARISON:

I have been asked by a number of people the results of our MPU (microprocessor unit) evaluations. We have probably had more experience in designing general purpose MPU hardware and software than any other group in the world. Therefore, our evaluations may be useful and hopefully interesting to anyone involved with small computers. I'm sure it goes without saying that we have a very active internal program concerning evaluation of all MPU's. Since we have no ties with IC manufacturers, our evaluations are essentially unbiased. Unfortunately, non disclosure agreements prevent us from discussing some of the newer unannounced MPU's. The following is a list of the processors which we have evaluated in detail.

Intel 8008, 8080, 4004, 4040
Motorola 6800
MOS Technology 6500 series
National PACE, IMP 8
Fairchild F-8

In order to keep this evaluation short I have reduced our internal criteria to the following major items:

1) Design Complexity of CPU - this is important only to the manufacturer and to the home brewer.

2) Hardware Flexibility - this is a measure of the flexibility of the system to interface to other hardware.

3) Memory Efficiency - a measure of how efficiently the system uses memory particularly important from a cost standpoint.

4) Power of Instruction Set - all measure of software power must be done on the basis of relatively large software packages, small or singular routines tell nothing about system power.

5) Overall System Speed - this is a measure of both hardware and software speed.

6) Availability of Software - a measure of which systems have the largest amount of manufacturer supplied software.

7) Reliability of Primary Vendor and Number of Second Sources - this will give an indication of the availability of new software and compatible hardware.

8) Overall System Speed - this is really the best single measure of system performance, but is only applicable when related to large real-world software packages, we use BASIC as a comparison. The following is a thumbnail chart.

—CONTINUED PAGE 4—

Ed Roberts, continued

	PACE	F-8	6500	6800	8080	8008
Complexity	G	E	E	E	F	P
Flexibility	F	F	G	G	E	G
Memory Efficiency	F	G	E	G	E	F
Power of Instruction	G	F	F	G	E	P
Avail. of Software	P	F	P	G	E	G
Efficiency of Software	F	F	G	G	E	G
Speed	F	F	G	G	E	P
Reliability of Vendor	P	G	G	E	E	G
Suitability as a G.P. Processor	F	P	F	G	E	G

E - Excellent
G - Good
F - Fair
P - Poor

There are several things that are apparent from the evaluation. The 24 bit byte oriented processors are in general superior to the 16 bit processor (PACE, the IMP 16 is not even in contention). The "old" 8008 is almost as good a processor from a general standpoint than some of the newer processors, of course, it is significantly slower. The 8080 is still the most powerful single chip LSI processor available but the 6800 is certainly good competition. As a matter of fact in simple minimal systems the 6800 is preferred due to the simplicity of interfacing, it is the logical choice for someone who is planning to homebrew a small system. If you are interested in a more detailed report on our evaluation, let me know and we will write a full and complete article on the subject.

CLUBS:

The majority of the computer clubs that exist today are a result of the catalyst provided by the MITS road show. We are very interested in continuing to provide whatever assistance we can to clubs. At the present time our typical customer is relatively sophisticated in terms of general electronics technology and/or software, but the vast majority of the potential customers in this hobby are not sophisticated. These new people are certainly needed by MITS and other manufacturers and their volume will benefit either directly or indirectly everyone in the hobby. A large percentage of the education and assistance getting these new groups up and running will have to come from the clubs, there is no other place. Our present efforts with the van only scratch the surface, incidentally the present van show is a basic technical presentation and not a sales pitch. We are actively working on a number of different courses which may prove useful to many of the clubs.

Any club which would like to have a technical group from MITS come to their meeting, please let me know and we will be there. If you would like an equipment demonstration and/or sales pitch we have representatives and dealers scattered all over the country who would love to have the opportunity to attend your meetings.

PARANOIA:

I have received a number of letters from readers of this publication concerning our counter attack of the armchair experts and others. The majority of those letters have been critical in the sense that they seem to say we are wasting time attacking these characters. This criticism is very gratifying in the sense that it indicates that our typical customer is more than sophisticated enough to establish the attacks on MITS and the Altair for what they are. Therefore, in the future we will address these sort of comments only in response to letters you send us and in the general design philosophy section of this column.

NEW PRODUCTS:

As I indicated last month as a general rule we will not release information on new products until they are production ready. But there have been some inquiries concerning the -2 and -II designation on some of the newer cards produced by MITS. Cards designated in this way are designed to be compatible with the until now unannounced Altair II. Let me just say the Altair II will be at least as revolutionary as the original Altair was when it was introduced. All -II cards have downward compatibility with the Altair 8800 systems, non-II cards probably won't interface with the Altair II.

Another product which has gotten a good bit of unintentional publicity is the MITS CRT graphics terminal. This is a product that has been under active development for more than two years. Because of the great amount of interest in this product let me break my own rule and give you some preliminary data.

In the alpha display mode it will present 80 characters per line, 24 lines per page. Up to 32 pages can theoretically be stored within the machine. There are two graphic modes, in the low resolution mode there are 256 x 256 elements. Any number of graphics pages and alpha pages may be interlaced and displayed under real time software control. The brightness of each frame in an interlace mode may be controlled. Control logic allows the system to be used with a standard color monitor if desired, i.e., full color graphics and alpha numerics are possible.

The data transfer rate between display and CPU is at main frame speeds, that is it should be possible to update the display at approximately 100 K byte rate, this is equivalent to a 1,100,000 baud rate. Of course, the display has upper and lower case capability, black on white and white on black and any of the other things you would expect in a terminal of this quality. The cost of this system will be significantly greater than the T-V typewriter type of display, but the capability will be much greater.

Our internal scheduling calls for shipments to begin in February, but you know how that goes. Nevertheless, we will not accept orders on this product yet, but if you would like to reserve a unit pending firm pricing and delivery schedules, write a letter to Barbara Sims and she will assign you a slot in production.

PUBLICATIONS:

We have mentioned the Computer Hobbyist in previous issues of Computer Notes, but I feel that it is such a valuable publication for the serious hobbyist it should be considered required reading. You can obtain a subscription by writing to the following address:

The Computer Hobbyist
Post Office Box 295
Cary, North Carolina 27511

Please send any comments or suggestions to me directly at MITS.

Highest regards,

Ed

David B. Porter
528 Carr Ave.
Rockville, MD 20850

Jim Gerow
2525 McCue #243
Houston, TX 77027

Peter Jarvis
10545 Ashworth N.
Seattle, WA 98133

Jerry K. Kozelsky
5711 Sarvis Ave. Suite 502
Riverdale, MD 20840

Jack J. Keith
3435 Mansfield Rd.
Falls Church, VA 22041

Olin A. Williams, Jr.
2871 Tony Dr.
Lawrenceville, GA 30245

James T. Mattley
6417 Fernhurst Ave.
Parma Heights, OH 44130

CONTINUED FROM PAGE 2

Altair Service Dept.

The only difference in AO and Air Mail is that the flap is taped rather than sealed for inspection purposes. It is impossible for MITS to take special requests for air mail due to the large amount of mailing we handle at one time. In the past, Computer Notes has usually been mailed around the 20th of the month. After the first of the year, we will try to start mailing a little earlier in the month. If for some reason you are not receiving your newsletter within approximately three weeks from the date it is mailed, then perhaps you should check with me.

Change of Address

When a school or company purchases the Altair, the sold-to address is used for our monthly mailings. If this is the case with you, and you would like to change the monthly mailing address to come directly to the user, drop me a post card with the purchasing name, 8800 order number and new address included. I will see that the mailing label is changed. If you mail or call in a change of address, please note that you are an Altair owner or user.

C/N Subscriptions

For some reason many of our customers think that the return of their warranty card initiates the subscription to Computer Notes. This is not true; your subscription begins in the month we ship your 8800 or 680 to you. Those customers with a computer printout invoice are immediately on the mailing list. Those customers who receive a white (7" x 8 1/2") invoice are put on our mailing list when their Altair is shipped. The same is true with time payment customers. If you purchased from one of our representatives or retail stores, then we add your name to our mailing list when we receive word from them.

Ordinarily, your membership in the Users Group will end in a year's time (in the same month you ordered your equipment). However, since there have been delays in getting Computer Notes out on a regular basis, no subscription will end until January 1977. This means if your ordered an Altair this year, your membership is good through December of next year.

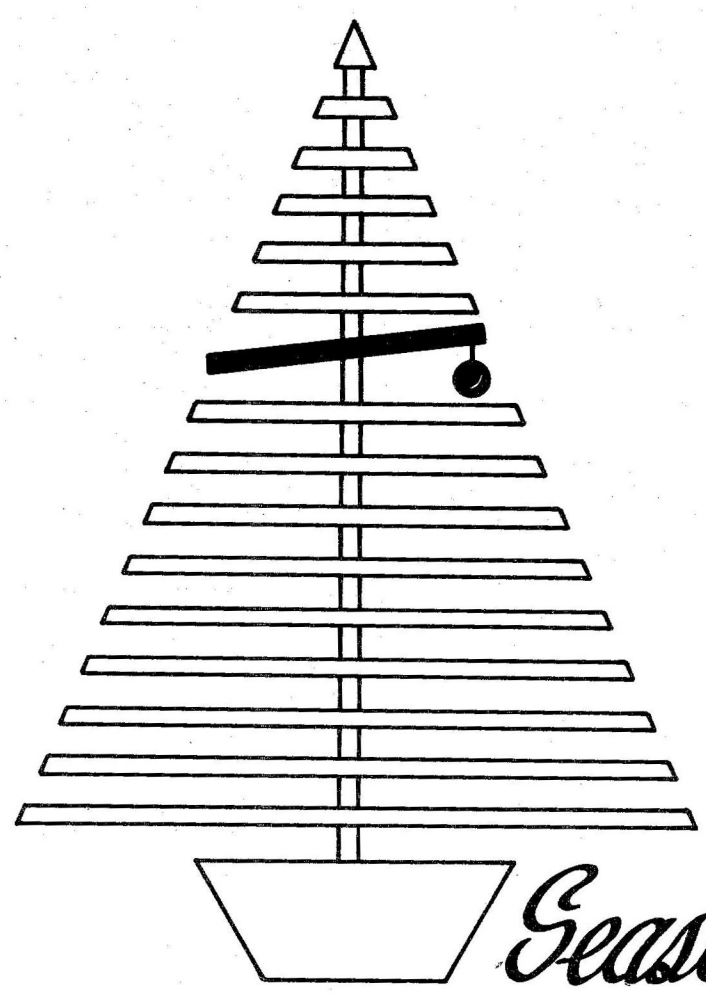
Invoices

Our invoicing has been changed to a new system which has caused a small amount of confusion to some customers. When you receive equipment from MITS, you will have a packing slip enclosed called our MITS order. A few days later you will receive a MITS invoice for this equipment. Please note on the invoice how your order was paid for. If you have prepaid the order, this invoice is for your records only. If your company is on a net 30 basis, the invoice is for payment. Hopefully this will clear up the confusion.

Classified Ads

A classified ads section is being introduced to our newsletter this month. Anyone who would like to advertise equipment for sale or trade, or has a want ad to place, should send a postcard to my attention with all the necessary information.

Barbara



Seasons Greetings

The following 4 pages of *Computer Notes* are reprints of 8 pages from *Creative Computing,* "the magazine of recreational and educational computing." Each issue of *Creative Computing* carries 4 or 5 games in BASIC, most of which will run without modification in Altair BASIC. (The Jan-Feb 1976 issue is entirely devoted to games and puzzles!) This 72-page bi-monthly magazine is also crammed full of other good stuff of interest to Altair users. Subscriptions are only $8 per year and all subscribers will receive a $5.95 computer art book free as part of their subscription.

COMPLEAT COMPUTER CATALOGUE

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing,* P.O. Box 789-M, Morristown, NJ 07960.

BOOKS AND BOOKLETS

TOWARD UNDERSTANDING THE SOCIAL IMPACT OF COMPUTERS

This very comprehensive 136-page book by Roy Amara is the distillation of the thoughts of 60 participants in four workshops held by the Institute for the Future. The principal message is that a real urgency exists to systematically understand how computers affect the decisions we make, the goods and services we produce, and the world we perceive. Specific topics discussed in-depth include: 1. Computer modeling and simulation as an aid to decision making, 2. Computers and financial processes, 3. Computer perceptions, attitudes, literacy, 4. Computers and individual access. A fifth could be added, "where do we go from here?" $10 to institutions, $7.50 to individuals and schools.

Institute for the Future, ATTN: Judy Flathman, 2740 Sand Hill Road, Menlo Park, CA 94025.

COMPUTERS IN EDUCATION

This ambitious little booklet (48 pp text, 14 pp appendices) boldly attempts to cover in three parts: How Computers Work, Administrative Uses of Computers, and Educational Uses of Computers. Indeed in the reading time of one hour, a person will get from this booklet a clear, concise and amazingly complete view of the computer in education. Last known price $1.00.

Computer Services, Province of Manitoba Dept. of Education, 103 Water Ave., Winnipeg, MB, R3C OJ2, Canada.

COMPUTERS BOOKLET

A 94-page booklet for 40 cents? Why, it's even difficult to get 94 sheets of blank paper for 40 cents. And yet here is one of the best basic descriptive books on computer hardware. It covers the birth of computers from the abacus and Babbage up to the present day, the anatomy of a computer including simplified explanations of some very sophisticated hardware, and finally some speculation about what's coming in the way of applications and large networks. The booklet simply titled *Computers* is written by William Corliss and published by the AEC, sorry ERDA. This one is a must. 40¢ each, even less in quantity. (Many other booklets are also available from ERDA; we recommend three: *Cryogenics, Teleoperators* and *Lasers.* Send $1.60 for all four.)

U.S. Energy Research and Development Administration, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. .

POPULATION AND FOOD

There are two interrelated and indisputable facts which many people have failed to comprehend: 1) world food production cannot keep pace with world population growth (not even with computer planning, miracle fertilizers, or plankton harvests from the ocean) and 2) "family planning" or new contraceptives cannot and will not, in the foreseeable future, check population growth. People are clearly looking for a miracle solution since the alternative, of course, is triage. Every person in the world, has an obligation to learn more about this situation which can only be described as a crisis. Send for a copy of the "Declaration on Population and Food" and a subscription to "The Other Side." Both free.

The Environmental Fund, 1302 Eighteenth St., N.W., Washington, DC 20036.

3 IFIP BOOKLETS

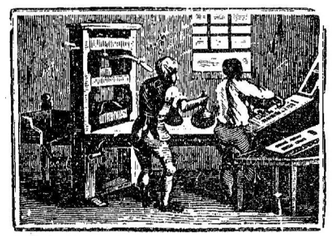
Three booklets have been produced between 1971 and '74 by various working groups of the International Federation for Information Processing.

Computer Education for Teachers in Secondary Schools – An Outline Guide is for those who are planning courses for the training of teachers. It gives suggestions for the content of courses although the information is of a very general nature. Includes 3 brief but excellent pages on methodology. 75¢.

Computer Education for Teachers in Secondary Schools – Aims and Objectives in Teacher Training. Booklet shows how society and education is changing and discusses the role of the computer in modern education. Lists brief outlines for seven courses. 75¢.

The Use of the Computer in Teaching and Learning. Describes ways of using the computer in education, the rationale and benefits. Discusses the necessary factors for a successful program – key people, instructional material development, facilities, and hardware acquisition. Depth of coverage is sparse (booklet has only 16 pages of text). $1.50.

AFIPS Press, 210 Summit Ave., Montvale, NJ 07645.



SMALL PRESS MATERIALS

Edcentric, Haiku Magazine, Tzaddikim, Feminist Art Journal, Fiction, Roar, Nitty Gritty, Blue Pig, Algol, Maybe, and *Quest* are just 11 of the approximately 1800(!) little magazines and small presses listed and described in the 1975-76 International Directory of Little Magazines and Small Presses. If you want a different view of the world, sometimes strange, sometimes ecstatic, but always refreshing, get this directory and send for sample copies of 10 or 20 little magazines. Directory $5.95 plus 50¢ postage.

Dustbooks, P.O. Box 1056, Paradise, CA 95969.

creative computing LIBRARY

Four sets of books covering major topics in computer literacy.

COMPUTER GAMES

101 BASIC Computer Games- Dave Ahl
An anthology of games and simulations- from Acey-Deucey to Yahtzee, all in the BASIC language. Contains a complete listing and sample run of each game, plus a descriptive write-up. Large Format. 256 pp. **$7.50**

What To Do After You Hit Return- Bob Albrecht
Another collection of games and simulations- all in BASIC- including number guessing games, word games, hide-and-seek games, pattern games, board games, business and social science simulations and science fiction games. Large format. 158 pp. **$6.95**

Fun And Games With The Computer- Ted Sage
Teaches problem-solving, flow charting and computer programming (in BASIC) in the context of well-known games of chance and strategy. 351 pp. **$5.95**

HAND CALCULATORS

Games, Tricks and Puzzles For A Hand Calculator- Wally Judd
This book is a necessity for anyone who owns or intends to buy a hand calculator, from the most sophisticated (the HP65 for example) to the basic "four banger". 110 pp. **$2.95**

The Calculating Book- Jim Rogers
Discover where you can buy gas during the oil crisis. An anthology of games, puzzles, puns, magic tricks and math problems that can be performed or solved with the pocket calculator. 125 pp. **$2.95**

150 Problems In Crypt-Arithmetic- Maxey Brooke
More grist for the calculator. 156 problems in which letters are substituted for numbers. Examine the number relations between the groups of symbols and solve the problem. 72 pp. **$1.25**

Advanced Applications For Pocket Calculators- Jack Gilbert
This book shows what you can do with your calculator after you balance your checkbook. As much as 80 or 90 percent of the capacity of the calculator is not used, and this book shows you how to use it- step-by-step- regardless of type. Explores all functions of all existing calculators, and all scientific and business applications. 304 pp. **$5.95**

COMPUTERS IN MATH

Problem Solving With The Computer- Ted Sage
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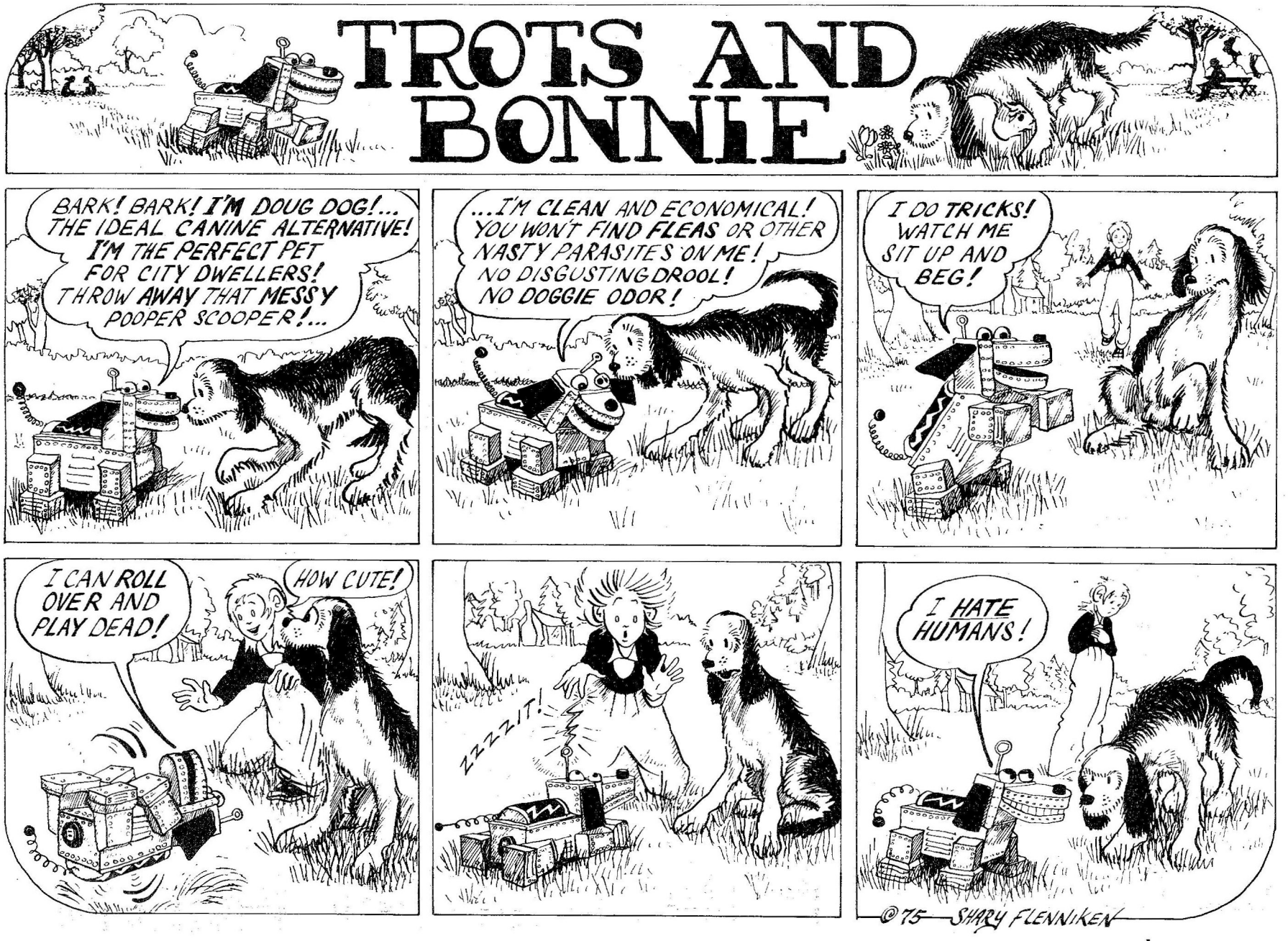
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I DO TRICKS! WATCH ME SIT UP AND BEG!
I CAN ROLL OVER AND PLAY DEAD!
HOW CUTE!
ZZZZIT!
I HATE HUMANS!
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Another new game from Creative Computing . . .

LUNAR

by David Ahl

LUNAR, also known as ROCKET, APOLLO, LEM, etc. is, next to STAR TREK and SPACE WAR, the most popular computer game. It is certainly the most popular on smaller machines. (I remember a milestone of sorts when I managed to compress LUNAR to run on 4K PDP-8 BASIC while retaining full instructions and landing messages. I used every single character available.)

The version of LUNAR presented here was originally written in FOCAL by Jim Storer, a student at Lexington (Mass.) High School in the mid 60's. While everyone claims to be the original program author of LUNAR, I'm reasonably sure that Jim predates the others and therefore qualifies as the original, original author. I converted the program to BASIC in early 1970. It's a straight-forward version without side stabilization rockets or other goodies but, nevertheless, is quite a challenge to land successfully.

PLAYING THE GAME

Your mission is to achieve a soft landing of your LEM on the moon. You separate from the command ship 200 miles above the surface of the moon and, every 10 seconds, set the burn rate of your retro rockets to slow your craft. You may free fall (0 lbs./sec.) or burn at any rate between 8 lbs./sec. and 200 lbs./sec. Since ignition occurs at 8 lbs./sec., burn rates between 1 and 7 lbs./sec. may not be used. A negative burn rate automatically aborts your mission.

There are three popular ways to land:

1. Constant burn rate all the way down.
2. Free fall for a while, then maximum burn rate tapering off as you get close.
3. Gradually increase burn rate to a maximum, then taper off as you get close.

Recall from physics that Newton found the force of attraction (gravity) between two bodies varies directly with the mass of the bodies and inversely with the square of the distance between their centers. This may help you land successfully. Then again, it may not.

COMPUTER NOTES

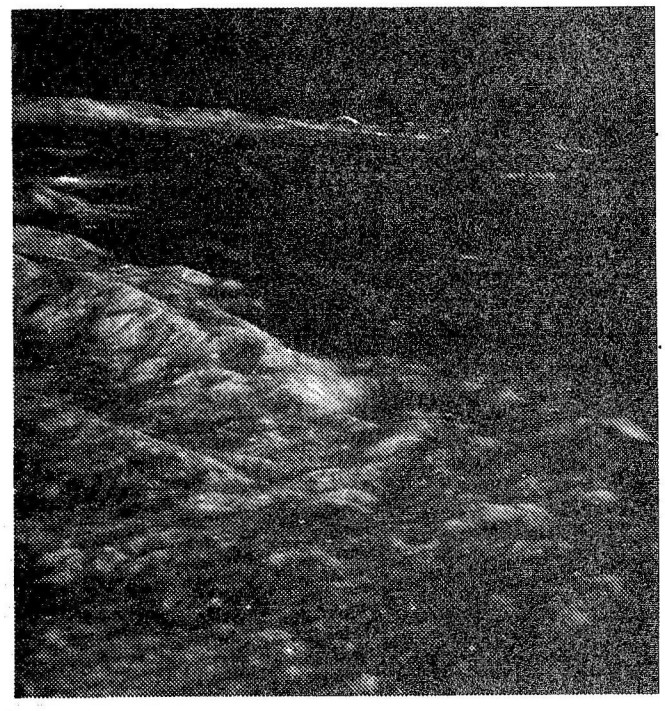
Convert the program to your version of BASIC. Multiple statements on one line are separated by a colon (:). Everything else is standard.

Some computers produce an error calculating the expansions (Statements 910 and 920) when you get close to the moon and the numbers get very small. If yours does, substitute the expanded form. Here it is for Statement 910:

$$-Q*(1+Q*(1/2+Q*(1/3+Q*(1/4+Q/5))))$$

You should be able to figure out the other one yourself.

Would you like us to print the other versions of LUNAR in *Creative Computing*? If so, write and let me know—DHA.



MAPPING THE MOON

This photograph pictures Mare Crisium, the large "flat" area near the eastern edge of the moon as seen from Earth. In the foreground is the mountainous terrain that forms the southern rim of Mare Crisium. Visible near the horizon, 285 miles across the mare, is its northern rim. Prominent at above right in the mare is the 24-mile-wide crater Picard. Photo was made from Apollo 10, the last flight before the lunar landing. (Photo Kodak)

SAMPLE RUN

```
RUNNH
LUNAR LANDING SIMULATION


CONTROL CALLING LUNAR MODULE. .

YOU MAY SET THE FUEL RATE (K) TO ZERO OR ANY VALUE
BETWEEN 8 AND 200 LBS PER SECOND.  A NEGATIVE FUEL
RATE WILL ABORT THE MISSION.

YOU HAVE 16000 LBS OF FUEL.
ESTIMATED FREE FALL IMPACT TIME IS 120 SECONDS.
CAPSULE WEIGHT IS 32,500 LBS.

FIRST RADAR CHECK COMING UP. . .
BEGIN LANDING PROCEDURE


TIME(SECS)     HEIGHT(MI)     VELOCITY(MPH)  FUEL(LBS)      FUEL RATE
 0              120            3600           16000          K? 0
 10             109.95         3636           16000          K? 0
 20             99.8           3672           16000          K? 0
 30             89.55          3708           16000          K? 0
 40             79.2           3744           16000          K? 0
 50             68.75          3780           16000          K? 0
 60             58.2           3816           16000          K? 0
 70             47.55          3852           16000          K? 200
 80             37.3656        3476.43        14000          K? 200
 90             28.2623        3072.94        12000          K? 200
 100            20.3232        2637.46        10000          K? 200
 110            13.644         2164.97        8000           K? 200
 120            8.33572        1649.14        6000           K? 200
 130            4.52958        1081.92        4000           K? 180
 140            2.2887         522.398        2200           K? 90
 150            1.22786        238.772        1300           K? 40
 160            .718389        127.493        900            K? 20
 170            .418089        88.5788        700            K? 22
 180            .237646        41.1605        480            K? 14
 190            .147722        23.5114        340            K? 10
 200            .859622E-1     20.9169        240            K? 10
 210            .317304E-1     18.0912        140            K? 12
ON THE MOON AT  218.451 SECS.
IMPACT VELOCITY OF  8.90172 M.P.H.
FUEL LEFT  38.5879 LBS.
VERY GOOD LANDING, NOT PERFECT YET.


TRY AGAIN (1 FOR YES, 0 FOR NO)? 0

CONTROL OUT

READY
```

PROGRAM LISTING

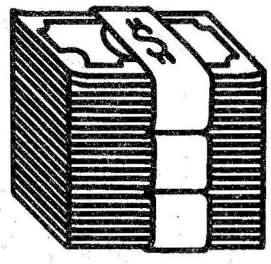
```
LISTNH
1 REM *** WRITTEN BY JIM STORER, LEXINGTON MS
2 REM *** CONVERTED FROM FOCAL TO BASIC BY  DAVID AHL, DIGITAL
10 PRINT "LUNAR LANDING SIMULATION":PRINT
20 PRINT:PRINT:PRINT "CONTROL CALLING LUNAR MODULE. ":PRINT
35PRINT"YOU MAY SET THE FUEL RATE (K) TO ZERO OR ANY VALUE"
40PRINT"BETWEEN 8 AND 200 LBS PER SECOND.  A NEGATIVE FUEL"
50 PRINT "RATE WILL ABORT THE MISSION.":PRINT
60PRINT"YOU HAVE 16000 LBS OF FUEL."
70PRINT"ESTIMATED FREE FALL IMPACT TIME IS 120 SECONDS."
80PRINT"CAPSULE WEIGHT IS 32,500 LBS."
90 PRINT:PRINT "FIRST RADAR CHECK COMING UP..."
100 PRINT "BEGIN LANDING PROCEDURE":PRINT:PRINT
110PRINT"TIME(SECS)","HEIGHT(MI)","VELOCITY(MPH)","FUEL(LBS)","FUEL RATE"
120 LET L=0:LET A=120:LET V=1:LET M=32500:LET N=16500
170 LET G=.001:LET Z=1.8
210 PRINT INT(L+.5),A,V*3600,M-N,"K";
220 INPUT K
225 LET T=10
230 IF K<0 GO TO 590
235 IF K=0 GOTO 310
240 IF K<8 THEN 260
250 IF K<=200 GO TO 310
260 PRINT "NOT POSSIBLE",,,,"K";
270 INPUT K : GOTO 230
310 IF M-N-.001 <=0 GOTO410
320 IF T<.001 GOTO 210
330 LET S=T:IF N+S*K<=M GO TO 350
340 LET S=(M-N)/K
350 LET I0=1 : GOTO 900
360 IF I <= 0 GOT O 710
370 IF V<=0 GO TO 380
375 IF J<0 GOTO 810
380 LET I0=1:GOTO600
410 PRINT"FUEL OUT AT ";L;"SECS."
420 LET S=(-V+SQR(V*V+2*A*G))/G
430 LET V = V+G*S
440 LET L=L+S
510 PRINT"ON THE MOON AT ";L;"SECS."
511 LET W = 3600*V
514 PRINT "IMPACT VELOCITY OF ";W;"M.P.H."
520 PRINT "FUEL LEFT ";M-N;"LBS."
530 IF W>=1 GOTO 550
540 PRINT "PERFECT LANDING!  CONGRATULATIONS!!": GOTO 590
550 IF W >=10 THEN 560
552 PRINT "VERY GOOD LANDING. NOT PERFECT YET.":GOTO590
560 IF W >= 25 THEN 570
562 PRINT "A FAIR LANDING, NO CRAFT DAMAGE.":GOTO590
570 IF W >= 60 THEN580
572 PRINT "CRAFT DAMAGE.  HOPE YOUR OXYGEN HOLDS OUT UNTIL A"
574 PRINT "RESCUE MISSION ARRIVES!":GOTO 590
580 PRINT "SORRY, BUT THERE WERE NO SURVIVORS."
585 PRINT "IN FACT YOU BLASTED A NEW LUNAR CRATER ";W*.277777;" FEET DEEP.
590 PRINT:PRINT:PRINT "TRY AGAIN (1 FOR YES, 0 FOR NO)";
592 INPUT R.IF R=1 THEN 90
595 PRINT: PRINT "CONTROL OUT" : GOTO 1800
600 LET L=L+S
610 LET T = T-S
620 LET M=M-S*K
630 LET A=I
640 LET V=J
650 IF I0=1 GO TO 310
660 IF I0=3 GO TO 850
710 IF S< .005 GO TO 510
720 LET S= 2*A/(V+SQR(V*V+2*A*(G-Z*K/M)))
730 LET I0=2 :GOTO 900
810 LET W=(1-M*G/(Z*K))/2
820 LET S=M*V/(Z*K*(W+SQR(W*W+V/Z)))+.05
825 LET I0=3 :GOTO 900
830 IF I<=0 THEN 710
840 GOTO 600
850 IF J>=0 THEN 310
860 IF V<=0 GO TO 310
870 GOTO 810
900 LET Q=S*K/M
905 IF Q<=0 THEN 1000
910 LET J=V+G*S+Z*(-Q*(1+Q*(1/2+Q*(1/3+Q*(1/4+Q*(1/5))))))
920 LET I=A-G*S*S/2-V*S+Z*S*(Q*(1/2+Q*(1/6+Q*(1/12+Q*(1/20+Q*(1/30)))))))
930 IF I0=1 GOTO 360
940 IF I0=2 GOTO 600
950 IF I0=3 GOTO 830
1000 LET J=V+G*S
1010 LET I=A-G*S*S/2-V*S
1020 GOTO930
1800 END

READY
```

Appollo 14 Launch Control Center, Cape Kennedy, Florida

Puzzles and Problems For Fun

▶ The number 153 = $1^3 + 5^3 + 3^3$ Find all other 3-digit numbers that have the same property. How about 4-digit numbers? To the 4th?

Bill Morrison
Sudbury, Mass.



▶ Mr. Karbunkle went to the bank to cash his weekly paycheck. In handing over the money, the cashier, by mistake, gave him dollars for cents and cents for dollars.

He pocketed the money without examining it and spent a nickel on candy for his little boy. He then discovered the error and found he possessed exactly twice the amount of the check.

If he had no money in his pocket before cashing the check, what was the exact amount of the check? One clue: Mr. Karbunkle earns less than $50 a week.

▶ Can you find the missing number for each diagram? You first have to figure the pattern which may be horizontal or vertical with a relationship between every number, every second or third number. You may have to add, subtract, multiply, divide, invert or do a combination of these things. Have fun!

A.

3	5		17
7		25	49
	37	73	

B.

	13	6
7	9	
12		10

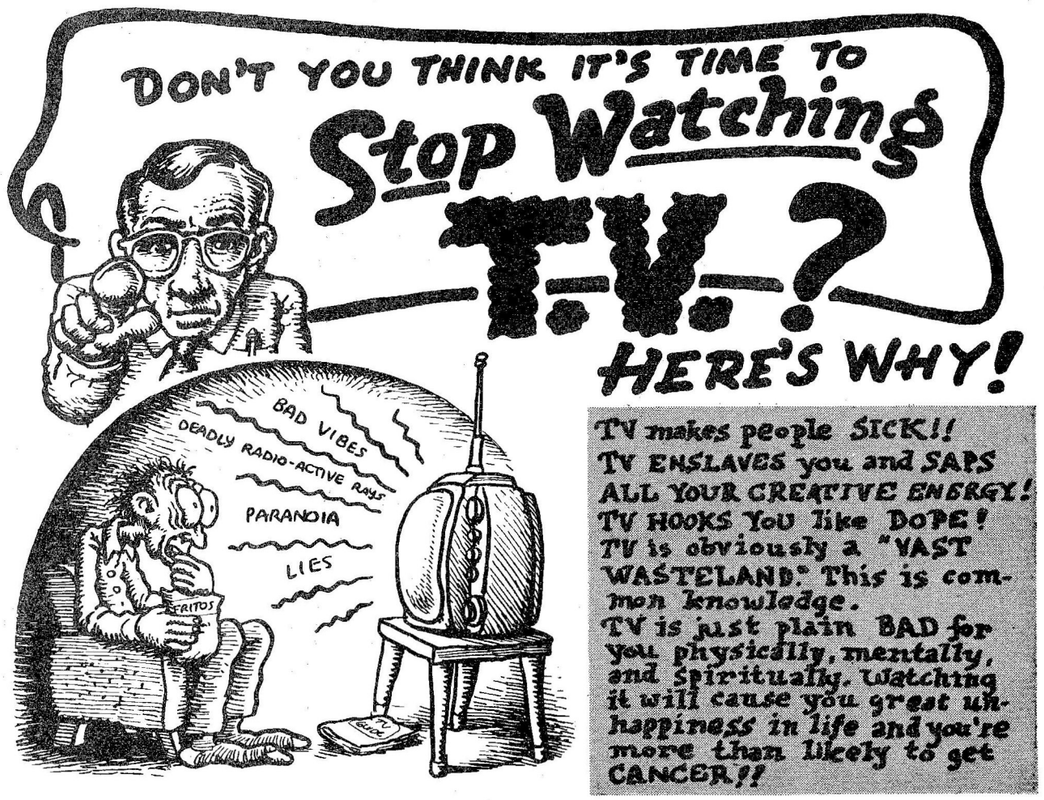
C.

4	20	5
	8	8
6	54	9
7	49	7

D.

```
      27
      _  _
   12  6  3
   _  4  _  1
```

▶ Send us your favorite puzzles for this column!!



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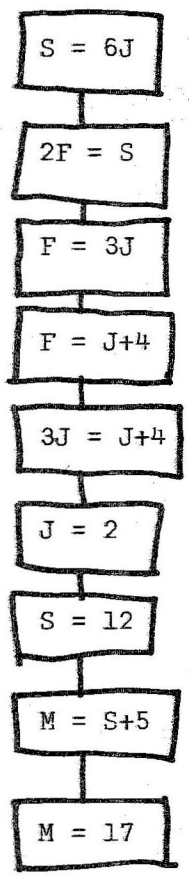
Introduction to Flow Charting

contributed by Thomas D. Thomas
Salem, Oregon

Part 1

Problem Definition: Sue has 6 times as many apples as Joe. Fred has half as many apples as Sue. Joe has 4 fewer apples than Fred. How many apples has Mary, if she has 5 more than Sue?



1. Define the number of apples that Sue has, in terms of the number that Joe has, from the problem definition.
2. Define the number of apples that Fred has in relation to Sue, from the problem definition.
3. Define a relationship between Fred and Joe, from steps 1 and 2 above.
4. Define the relationship between Fred and Joe, from the problem definition.
5. Substitution for simultaneous solution of steps 3 and 4 above.
6. Joe has 2 apples, from step 5.
7. Sue has 12 apples, from steps 1 and 6 above.
8. Relationship of Mary to Sue, from problem definition.
9. From steps 7 and 8.

Part 2

Discussion:

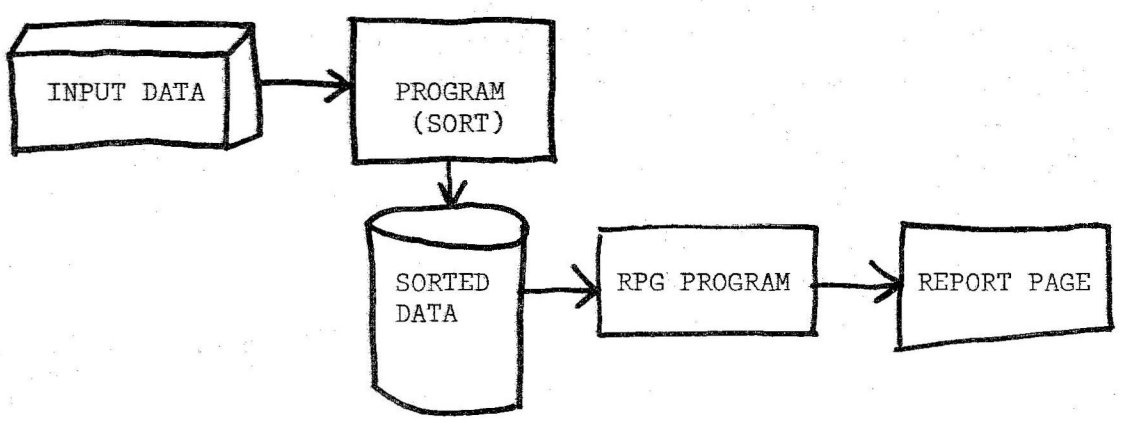
We are ready to ask ourselves, why flowchart at all? From the previous example, we see that Flowcharting forces us to clarify our thinking, by translating our solutions into a step-by-step procedure. Secondly, we have stated the problem, and its solution, in a language that is more universal than most programming languages.

We see then, that Flowcharting:
1. Helps us to formulate our solutions
2. Helps us to communicate our solutions to others.

As an example, let us communicate the solution to a data processing job to our employee, the programmer.

First, we define the problem:
A. Define the input information (data deck).
B. Define the output information (report).
C. Define the tools (language, computer, etc.).

Second, we communicate the general form of the solution in the form of the solution's flowchart:



Notice that the problem's solution is immediately clear, from the above flowchart, and that the programmer should have no difficulty in understanding what is wanted by his supervisor. That is, the input data is to be sorted and printed in report form, by two different programs. This simplistic flowchart may seem to add little to the understanding of the problem statement. However, look again at page 1, and compare the problem statement to the flowchart, to see that the flowchart may often tremendously clarify a problem statement.

Letters to the Editor

Last September - 15, I paid $30 for membership on your Altair Users Association - see MITS order 6768.

A few days after this date, I received the August issue of Computer Notes. Having been for over 15 years in the D/P industry, where the rather staid styles of the IBM and ACM publications set the standard modes of communication, I found your lively and informal news letter full of inspiration and human touches.

Perhaps someday you will be remembered not so much for your in-expensive hardware, but for having helped in the "humanization" of the computer industry.

Congratulations! Keep up the good work.

Mario F. Maffioli
Ponce, Puerto Rico 00731

Dear Mr. Bunnell:

I see in Computer Notes for October that there are many quotes from PCC for September. On pages 12 and 13 of the same issue of PCC there were some other comments of considerable interest to Altair owners.

Specifically:
1. Conditioning of the reset switch as per diagram shown.
2. Modification of the dynamic boards.
3. C-7 no greater than 4700 pF. Under "Arrowhead Tips" the final value is given at 0.01 uF.
4. Rewiring the PRDY to pin 3 of the bus.

Would you please give me your comments on these suggested modifications.

Dr. George L. Haller
Naples, FL

Dear Dr. Haller:

None of the modifications mentioned in the PCC article are required, and some will even damage your machine. But specifically to answer your questions:

1. Bounce in the reset switch can cause an undefined condition in the status latch, and this can result in a loss of data in the 4K memory boards. At this time there is only one solution to this problem: don't use reset once the machine is loaded (normally the case anyway). The modification proposed in PCC was tested internally and the only effect it had on our machines was to suppress the operation of the reset switch totally. If that's the goal, a simpler mod would be to remove the reset switch. In addition to the fact that it didn't work in the majority of the machines in which it was tested, it will permanently damage the reset switch due to high surge currents during the capacitor discharge. Never discharge a capacitor with a mechanical contact without using some sort of current limiting protection.

CONTINUED ON PAGE 21

Build this "Record and Play Switching Unit" for your Altair ACR

contributed by Craig Pearce

How many times have you run your output bootstrap program to record material onto tape, only to find that the cable in the back was connected to the 'Tape Play In' jack? If you're like me, probably about as many times as I've left the plug in 'Record Out' when I wanted to read a program into the core.

I immediately saw I was in a losing battle with what I call my "memory" (I think my brain's refresh circuitry has gone bad), so, I quickly roughed out and threw together a handy, simple switch box, then tacked on a few conveniences to make the unit a little easier to use.

With the "RPSU" both the record-out and play-in jacks on the back of the ALTAIR are connected to this unit at the same time. Coming from the unit are two cables that connect to the recorder's microphone input jack and the line output jack. A two-position rotary switch is used to select between the record (called 'store' for reasons explained later) and play modes.

Also, the box contains a built-in, 1-watt amplifier module for monitoring of signal on playback (and during record, if the tape recorder allows this), plus a seven-segment LED display to indicate the mode. (An "S" for Store--or record--and a "P" for Playback. The reason for the term 'store' now becomes obvious, since an R (for record) looks more like an "A" on a seven-segment display.)

The builder can use any enclosure and any 6-volt DC source that he wishes. The parts used by this author are listed in a table to follow.

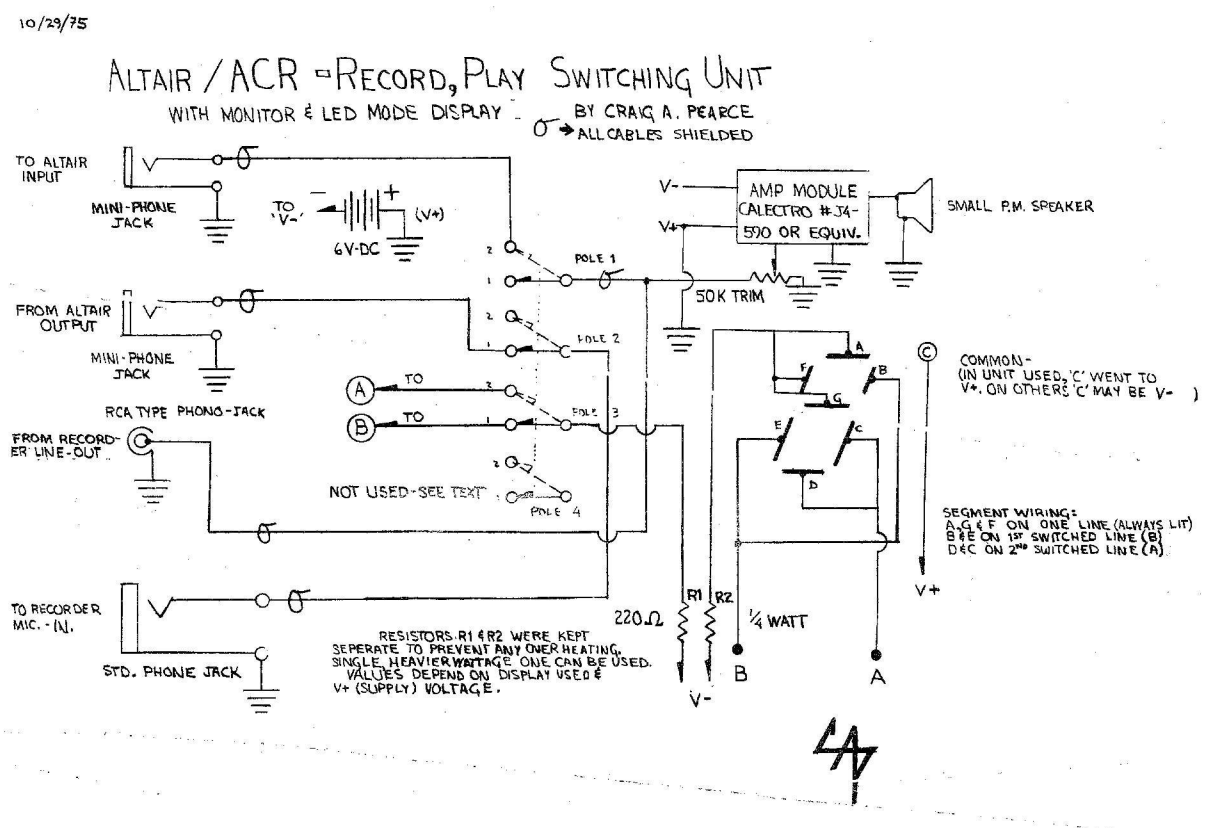
Construction is quite straightforward. The various parts to be mounted on the front panel should be laid out first and then the holes drilled. A series of holes, or one large one with a grill cloth, should be made for the speaker. One IMPORTANT NOTE: Always check to see component placement on the front panel does not interfere with internal component placement. The switches and speaker do displace some area inside and many times have I found a homebrew project does not fit together because of this problem.

Another point to remember is always use a NON-SHORTING type switch. This prevents the in and out lines on the ACR Modem from getting shorted together. (A non-shorting switch is said to "break before make," or disconnect one lead before connecting the other. In contrast, a shorting, or "make before break" type switch will intentionally short adjacent contacts as it is moved from one position to the next.)

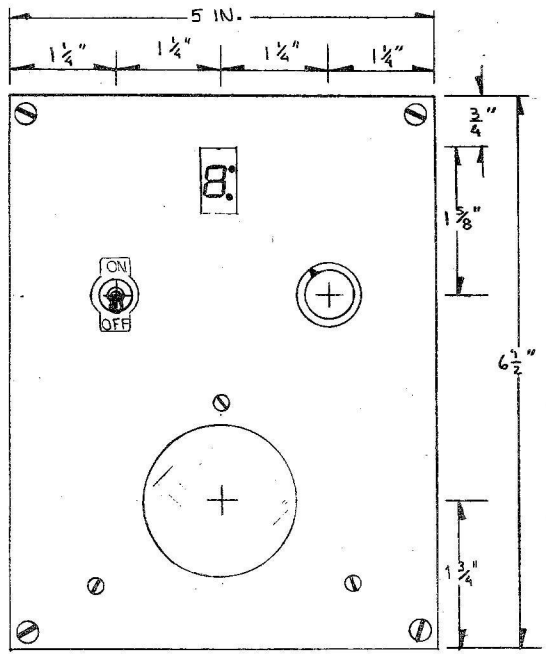
For those who wish to assemble the unit like the author's, a complete set of drawings accompanies this article. (see next page)

Hopefully, your leads will no longer be misconnected when using the ACR-Modem. Unless, of course, you forget to throw the switch.

--see page 13 for parts list--

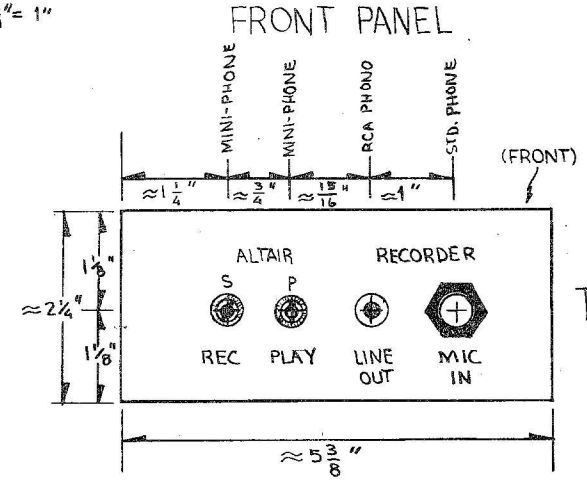


— see construction drawings on following page —

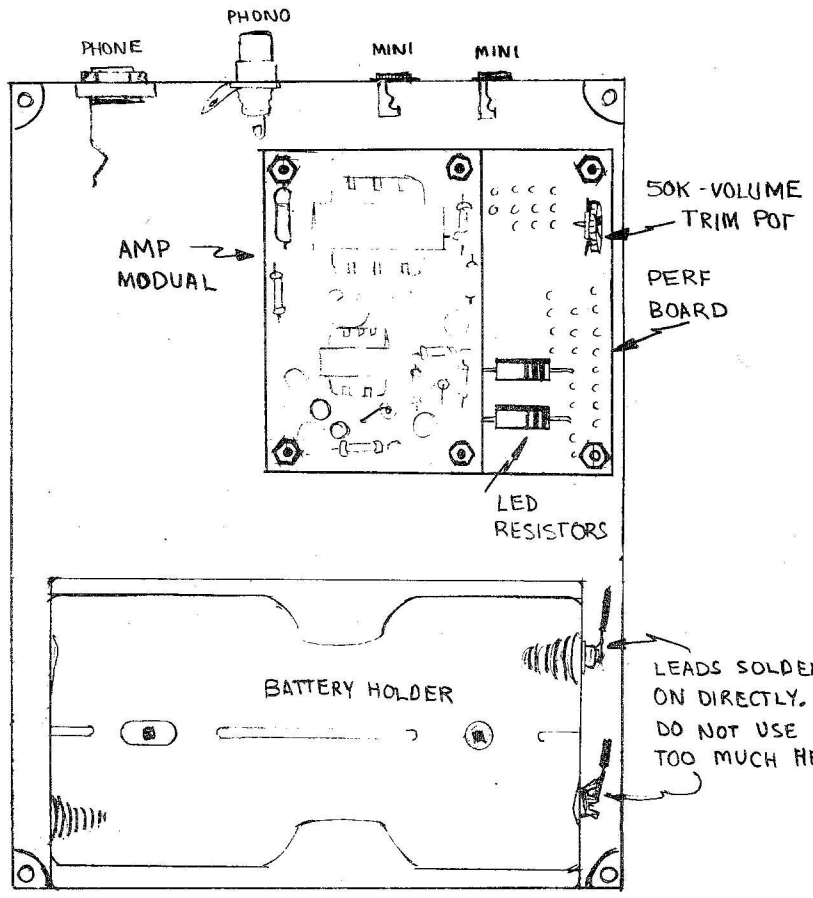


SCALE: ¾" = 1"

FRONT PANEL



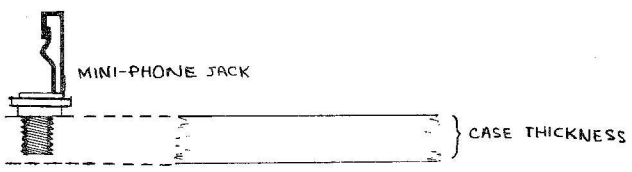
TOP VIEW



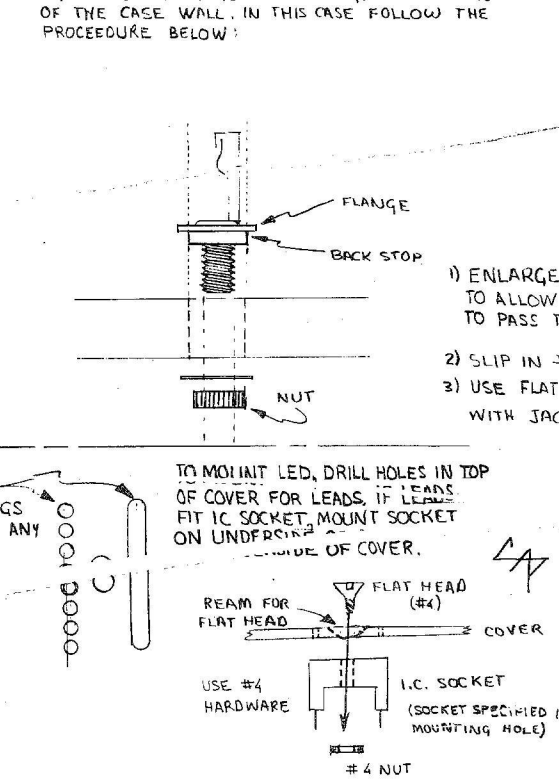
INTERIOR VIEW - COMPONENT LAYOUT

(USE SHIELDED CABLE ON ALL AUDIO SIGNAL CARRING CONNECTIONS)

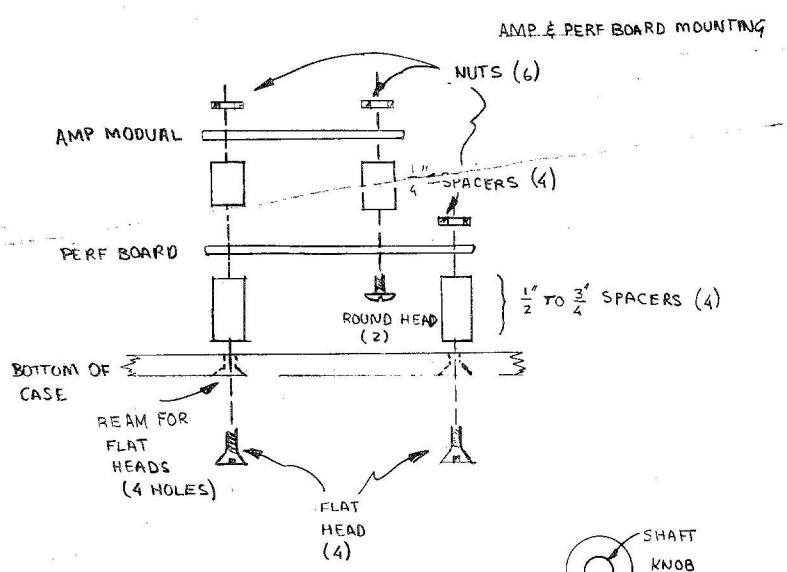
MINI-JACK INSTALLATION ~ I.C. SOCKET USE

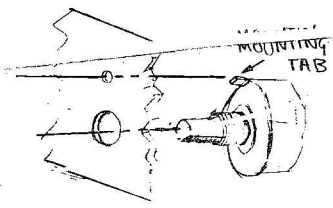


YOU MAY FIND THAT THE NECK OF THE MINI-PHONE JACK IS TOO SHORT TO FIT THROUGH THE THICKNESS OF THE CASE WALL. IN THIS CASE FOLLOW THE PROCEEDURE BELOW:

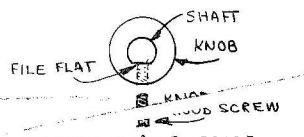


CONSTRUCTION HINTS & TIPS





TO PREVENT SWITCH FROM SLIPPING, DRILL HOLE FOR MOUNTING TAB, AS SHOWN



TO STOP KNOB SLIPPAGE, FILE 1 SIDE OF SHAFT FLAT, AS SHOWN

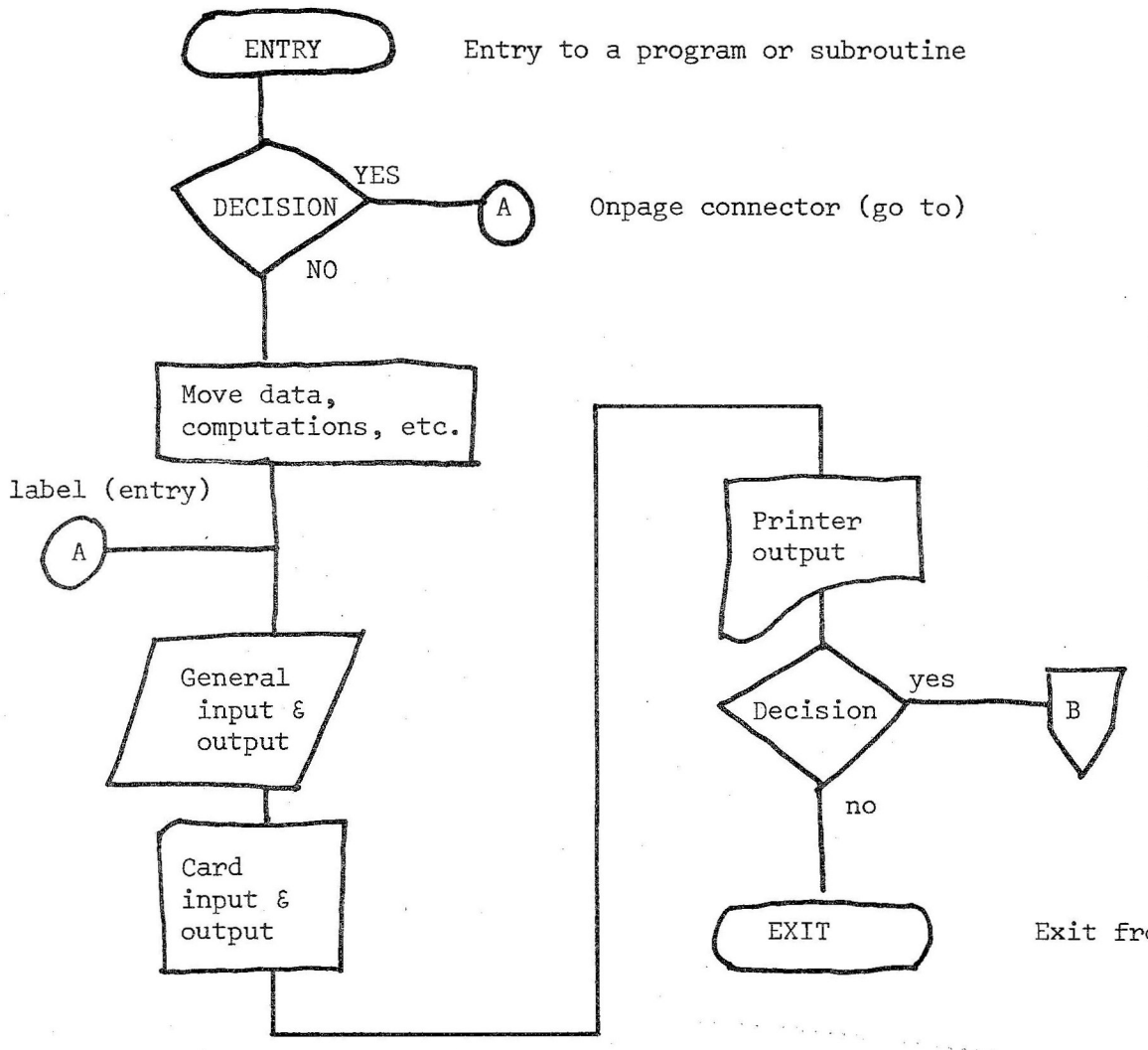
NOTE: UNUSED SWITCH TERMINALS FOR POLE 4 MAY BE USED FOR GROUNDING CONNECTIONS IF THEY ARE SHORTED TOGETHER

CONTINUED FROM PAGE 10

Flow Charting

Part 3

Definition of symbols commonly used by programmers.



Note that connecting lines that point DOWN or to the RIGHT need no arrowheads to indicate direction. Connecting lines that point UP or to the LEFT should have arrowheads indicating direction of flow.

--continued from page 6

PARTS LIST for RPSU

1	Seven-segment LED display chip	(Calectro #J4-975 or equiv)
1	IC socket (for display)	(" #F2-998 ")
1	Audio amp module	(" #J4-590 ")
2	220 ohm, 1/2 or 1/4 w 10% resistors	(" #B1-376 ")
1	50K ohm trimmer pot (for volumn adj.)	(" #B1-645 ")
1	Two-inch speaker	(" #S2-202 ")
1	SPST light duty switch (ON-OFF)	(" #E2-130 ")
1	2-position rotary switch with 3 or > poles: NON-SHORTING	(" #E2-167 ")

PANEL MOUNTING JACKS:

2	Mini-phone type	(Calectro #F2-845 or equiv)
1	RCA Phono type	(" #F2-806 ")
1	Standard phone jack	(" #F2-848 ")
1	Case	(Calectro #H4-729)

CABLES: (Bought or made)

2 with male, mini-phone plugs on eigher end
1 with RCA type phono plugs on either end*
1 with std. male phone plug on either end**

1 6V (4 cell) C-battery holder (Calectro #D3-064 or equiv)

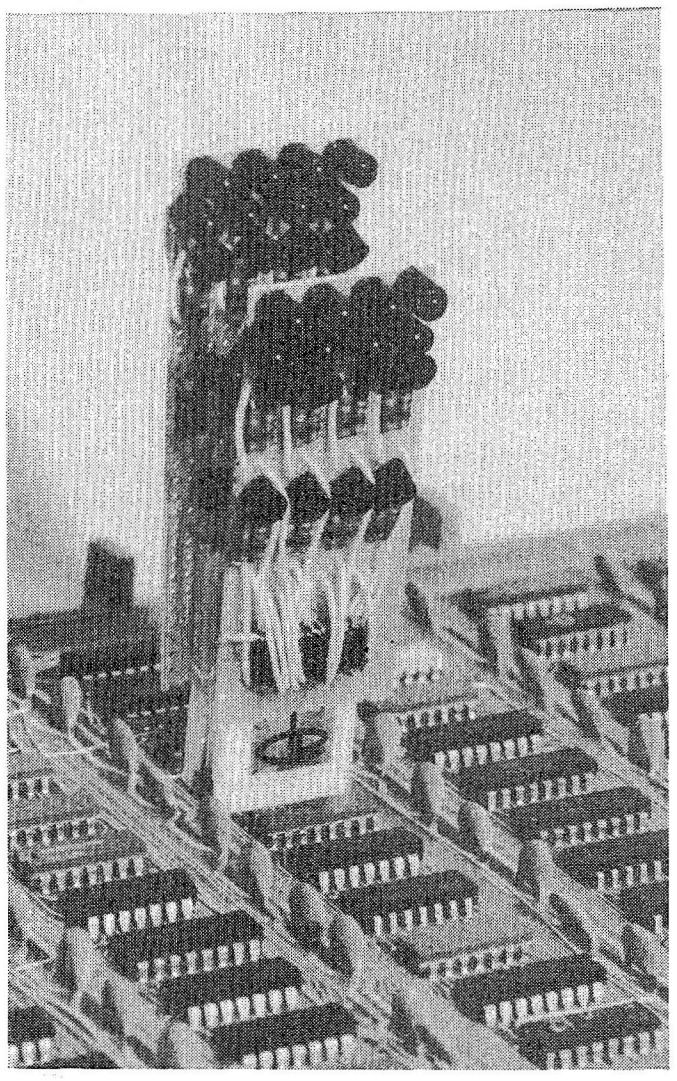
MISCELLANEOUS:
Shielded cable, C-cells, hook-up wire, mounting hardware, perf board and solder

*one end should have plug to fit the out jack on your tape recorder
**one end should fit the microphone in jack on your tape recorder

Powerless IC Test Clip

circuit by
John Errico

written by
Robert Baker



This test clip operates like the expensive, commercially available clips selling for $85 or more without requiring batteries or external power. All types of ICs may be tested (TTL, DTL, MOS, etc.) and LEDs are used to indicate the logic state of each pin being tested.

The heart of the test clip is a Texas Instruments TID125 diode array which costs about $3.75. Two diode arrays are used to determine the pin with the highest voltage (Vcc) and the pin with the lowest voltage (ground). These pins are then used to power the LEDs on the test clip itself, thus taking power from the IC on the board and eliminating the need for an external or separate supply. The circuit is straight forward and may be expanded to make a 24- or 40-pin test clip. The larger test clip, however, may be difficult to use due to the size of the LED display.

The basic IC clip is a standard item available from AP Products Inc., Box 110-Z, Painesville OH 44077. The 16-pin clip is part number 923700 (TC-16) and sells for $5.75 each.

The diode arrays are 14-pin dip packages and were chosen to make the test clip more compact. To cut down the cost, 16 general purpose silicon diodes may be used in place of each diode array IC. The transistors used to drive the LEDs may be any NPN transistor capable of handling the LED current. Any small size LED may be used; however, the 1k resistance value may have to be changed. Choose a value which gives about 2 mA current through the LED; this should give sufficient brightness without loading down the circuit supply.

Construction is very simple and parts layout is not critical. Use a small piece of 0.1" grid perforated board bolted to each side of the IC clip to mount components on. Try to keep the overall physical size of the boards as small as possible to make the finished test clip easier to handle. The LEDs should be mounted along the top edge of the perforated boards so they are visible from above the clip when it is attached to an IC. I would suggest wrapping a small piece of dark tape or using a short piece of dark tubing around each LED to improve visibility of the finished LED display. One of the TID125 diode arrays is mounted on each piece of perforated board along with the associated resistors and transistors, positioned wherever convenient. Remember to run two wires between the two perforated boards to connect the Vcc and ground outputs of the diode arrays together. These wires should be stranded to withstand the movement of opening and closing the test clip when in use.

Using the test clip is the simplest part of all. Just clip it over the desired IC. Don't worry about how to position the test clip on the IC; pin 1 may be at either end and the test clip will still work properly. With the test clip installed on an IC package the LEDs will indicate the logic level of each pin:

ON = Logic 1 (HIGH) or Vcc pin
OFF = Logic 0 (LOW) or ground pin

On 14-pin ICs disregard the two pins not attached.

Who said building an IC test probe is hard? ■

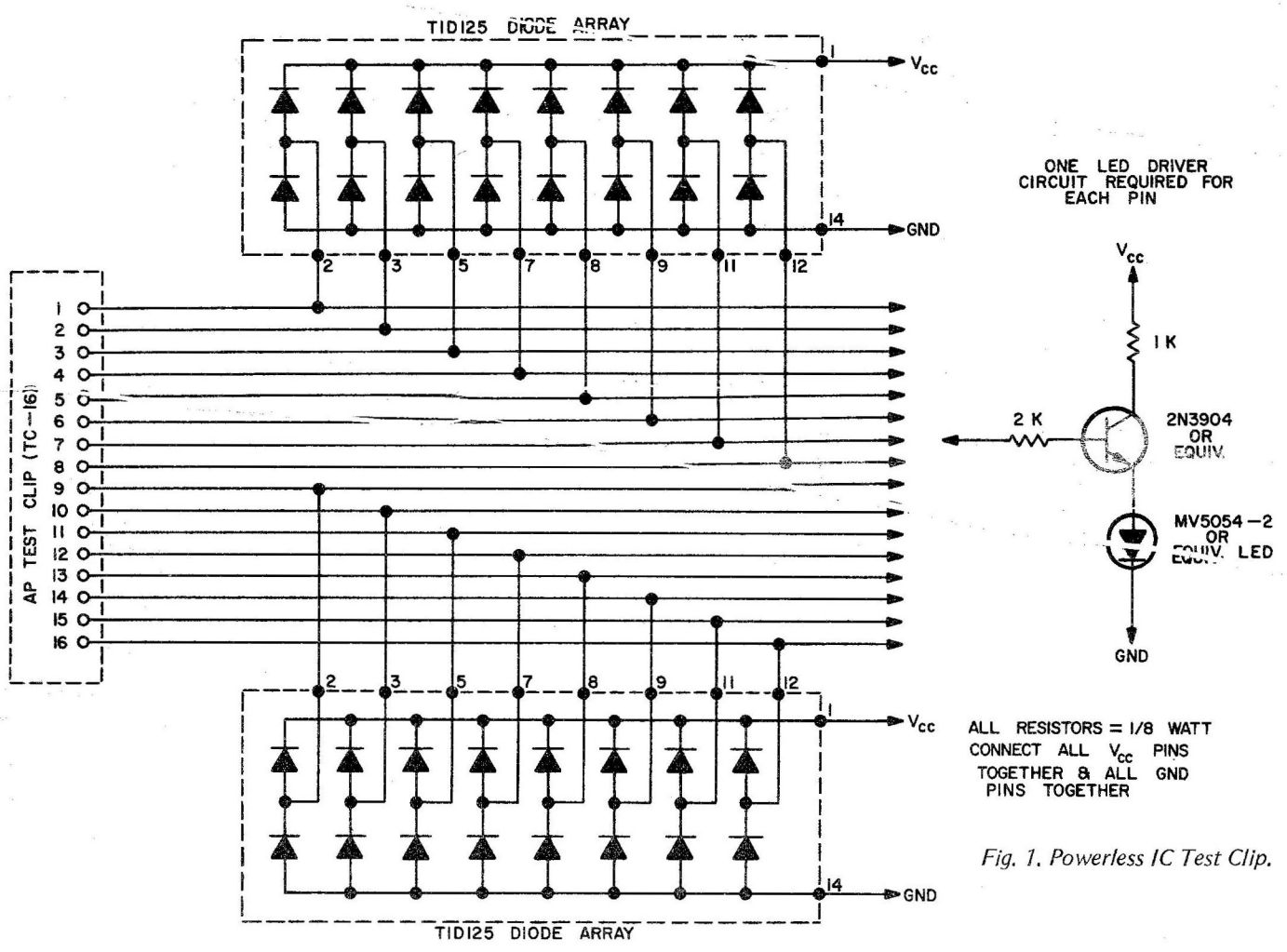


Fig. 1. Powerless IC Test Clip.

Reprinted from *BYTE Magazine*, December, 1975.

Recycling Used ICs

by
Carl Mikkelsen

The surplus market is saturated with used printed circuit boards from early computer systems which offer a very inexpensive per chip source of ICs. Used boards typically contain 50-200 chips of small scale or medium scale integration, usually with many simple two input gates and four bit data registers. Common part numbers include 7400, 7402, 7404, 7408, 74126, 74174, 74175, etc. Through careful shopping, I have found boards with large numbers of multiplexors such as 74151, 74153, and even scratch pad registers — 7489. After removing chips from the boards and eliminating any non-functional units, cost per chip is from 3 to 8 cents, resulting in an overall cost of about one fourth to one tenth of the individual chip cost through other surplus outlets.

Removing chips from boards offers advantages over purchasing chips surplus which makes them attractive for reasons other than price. Primarily, the companies which originally built the boards used top-quality, fully spec'ed components. All chips have already been tested, and most have already served in equipment.

Given that you've found a serendipity of well soldered chips, it's necessary to unsolder them without either burning them or cracking their cases. Desoldering individual leads can be done, but usually the chip is made unnecessarily hot by the prolonged application of heat. Also, pulling each lead out separately results in bent, often broken leads. Devices are available which will heat all 14 or 16 pins of a small IC, but again a long time is needed to melt the solder since the total amount of energy available is limited to a small soldering pencil heating element. Most available boards are two sided and four layer boards aren't uncommon. Multi-layered boards make the required amount of energy even higher.

When a board is built, the ICs are positioned in place with all other components, and the board is soldered by a three step process.

1. The underside is washed by hot, bubbling, liquid flux.
2. The clean board is passed over a small fountain of solder, so that the board just touches it.
3. After cooling, the board is immersed in FREON gas to remove any remaining flux.

As you can see, the board is subjected to high temperatures during the soldering phase, which takes around 5-10 seconds.

The blow torch method of IC removal duplicates conditions during board soldering by heating all pins simultaneously; removing the IC is a single step.

Equipment Needed

To use this technique, you will need:

A torch. Non-oxygenated propane and acetylene gas has been used.

Clamps or a vise to hold the board fairly rigid during chip removal.

A way to grip the chips, depending on how they are packed next to each other. Components, small vise grips, a small screw driver and a fine point awl should be all that are needed.

A place where splashed solder will not be serious.

Some form of eye protection.

WARNING 1

Using this method involves heating PC boards to high temperatures. Some boards release Hydrogen Chloride (HCl), which becomes hydrochloric acid in your lungs. Do this only in a well ventilated area, and stop to allow air to clear if irritation develops.

WARNING 2

When an IC is pulled from a board, the board often snaps back to its original position. This is especially true if it isn't fixed very rigidly in place. When the board flips, solder is often sprayed away from the back side of the board. I ruined a pair of pants by not considering this before I started. I, therefore, wear old clothes and if you don't want solder on the floor, cover it with newspapers.

Enough warnings . . . following is how I pull ICs from boards:

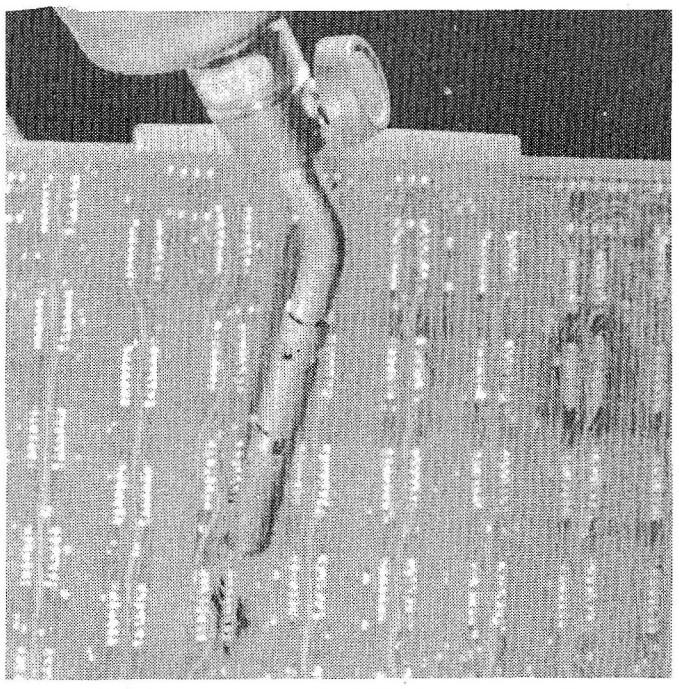
First I clamp the board to my bench so that I can get my vise grips on about half the ICs (this is with a 10" x 14" board). I adjust the vise grips so I can grip a 14 pin IC without the vise grips locking and then light the torch. The flame on my Benzo-matic torch with the narrow tip is about an inch long.

Beginning with the lowest IC I can reach, I heat it with the torch by sweeping the torch over its pins (you obviously heat the non-component side). Especially when using a torch with a narrow flame it is necessary to move the flame over the pins. One complete sweep should be done once or twice a second. After a second or so, the IC should be gripped, and rocking tension away from the board applied. It helps to rock the IC, especially if corner pins have been bent over to hold the IC in place during assembly. The IC should very rapidly become loose, and in another couple of seconds should come free of the board.

When the IC is removed, quickly drop it on the bench and move the torch and pliers to the IC above the one removed. Heating the lower IC pre-warms the board above, making the next removal easier. Also, the board position just heated will cool faster, thereby reducing the amount by which the board will be damaged.

As each column of ICs is removed, the next is done. When all ICs on one half have been removed, reposition the board so the other half is accessible. I've found that the half-way point often can be a good excuse to let the room ventilate and drink a beer.

No matter how carefully and rapidly I've worked, I always burn the board at least once because I have trouble removing an IC, or my pliers slip, or for some other reason. If you consistently burn each board position, your flame is probably too hot. If, however, it takes longer than 5 to 10 seconds to remove an IC, your flame is too cool.



Sweep the blow torch over the IC's pins—one complete sweep once or twice a second.

A certain amount of care is necessary when gripping the ICs. Too much pressure may crack them. Too little pressure will let the pliers slip, costing time to reposition them and marring the cases.

When attempting to remove the larger ICs such as 74181s and 74154s, which come in 24 pin DIPs, I have trouble gripping them, so I remove them as a two step process. First, I place an awl under the middle of one side, say between pins 6 and 7. I heat that pin row and, with the awl applying leverage, pull out that row. I then grip the IC on its thinnest dimension, heat the remaining pins, and remove the IC.

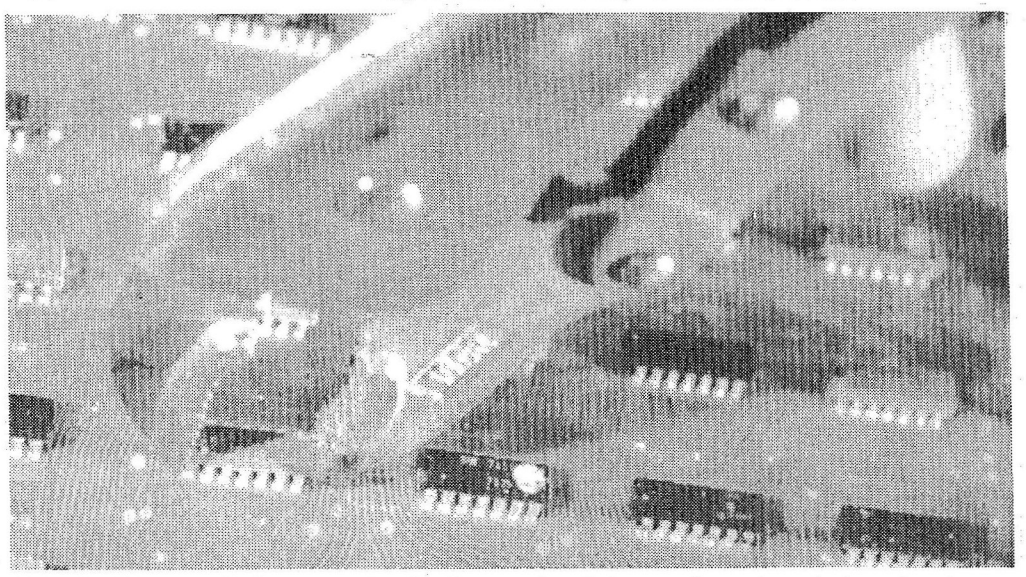
So far, by using this technique, my friends and I have removed about 1000 ICs from surplus boards which have about 80-100 ICs each. I tend to break 2% of the chips I pull by applying too much force with the pliers. But a friend has never broken one, so it clearly is an individual matter. Of those chips removed unbroken, we have tested around 250, and have never found a bad chip.

As an unrecommended demonstration of the ruggedness of ICs, I accidentally grossly overheated one, so that when I gripped it in vise grips, the chip was bent in a curve. The plastic case must have softened significantly. After allowing it to cool several minutes to the point where I could handle it by hand, I plugged it into a circuit, expecting it to have failed totally. It worked, although I didn't check out its ac characteristics. Out of general paranoiac distrust for a device so intensely mistreated, I discarded it.

After removing ICs from boards it is usually necessary to clean and straighten the pins. Boards with plated through holes often lose their plating around the IC lead.

I have found this method useful as a means of quickly building a stock of ICs ready to use in any project. It is limited mainly by the availability of exotic surplus chips, but most standard 7400 series TTL is easily available. The price of 4 cents/chip can't be beat, and the time required — about 10 to 20 minutes/80 chip board — is rather small.

This technique provides a fast, cheap, safe means of removing chips. I hope it proves as effective for you as it does for me.



Grip the IC a second after removing the flame and rock it away from the board. It should come free in a couple of seconds.

There's More to Blinking Lights Than Meets The Eye

A blinking light peripheral is an inexpensive, entertaining addition to your computer system. The use of multiple indicator lamps under computer control to produce moving patterns can lead to many hours of creative programming and pleasant amusement.

Playing with blinking lights is nothing new to people working with computers. Early systems, to say nothing of science fiction movie caricatures, tended to have monstrous front panels with row after row of indicator lamps. These lamps were used to reveal various machine states. As computers became more sophisticated, the need for many of these indicators diminished, but the fascination of making the indicator lamps dance and gyrate in interesting patterns has remained.

As a simple example of moving lights, consider a single 8 bit byte of memory in your computer, which might be called BLINK. Assume that you have also constructed an 8 bit output data latch which drives eight LEDs as shown in figure 1. When a certain program is started, BLINK might be initialized as follows:

0 0 0 0 1 0 0 0

Suppose this value is sent to the display, which is set up so that a 1 bit lights an LED, then the display will look like this:

● ● ● ● ○ ● ● ●

The key element in creating an illusion of motion is time. If the program starts out with data as shown above, waits a short time, then executes a left rotate instruction, a new pattern will be obtained. The new binary value 0001 0000 can be sent to the display:

● ● ● ○ ● ● ● ●

In the simplest of all motion programs, these three steps are repeated in an endless loop:

1. Rotate BLINK left one bit position.
2. Send BLINK to the display.
3. Wait n milliseconds.
4. Go to step 1.

With a program executing these four steps, the pattern of lit indicators will be seen moving to the left, disappearing on the left in the same step at which it reappears on the right. By changing the program delay (step 3), the speed of the pattern's apparent motion can be changed.

Figure 1 shows two quad latches which are used to drive 8 indicator lamps. The 220 O resistors are typical values for LEDs as indicators. This value allows reasonable brightness with most LEDs. The complement outputs of the 7475 ICs used as latches produce a lit LED for each 1 bit received. When you purchase LEDs for a blinking light display, make sure they are all the same, as the display will not look as attractive if lamps of different types are mixed.

Now, suppose you use four latches for 16 bits of data and 16 LEDs. How do you program an 8 bit computer to do the shifting

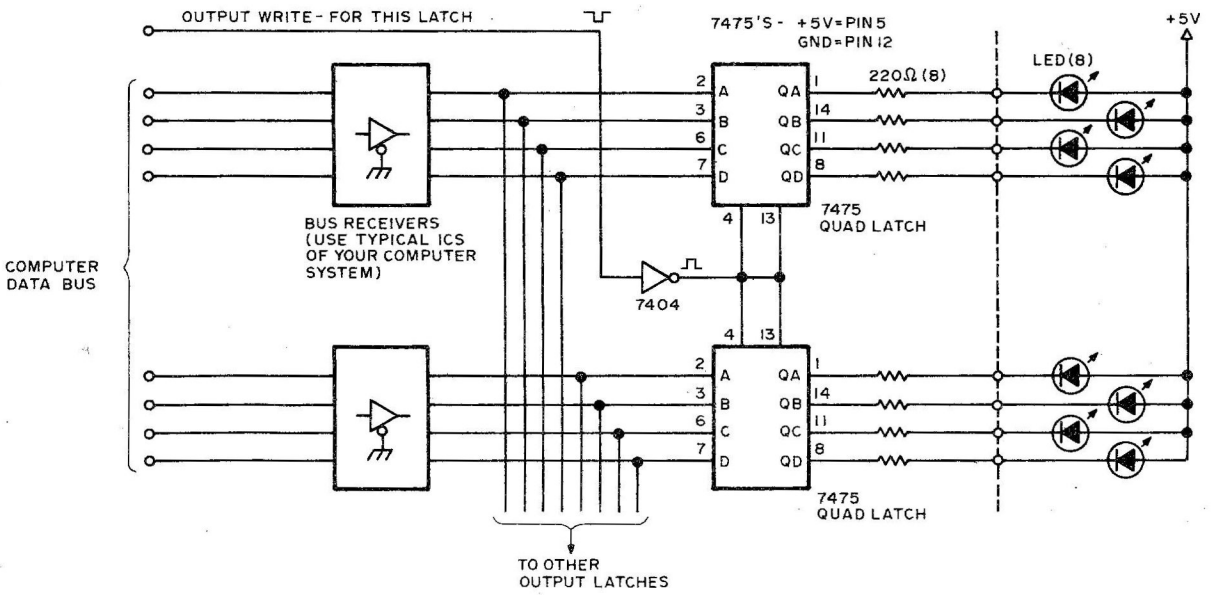


Figure 1: The basic "straightforward" approach to display lamps. One latch is assigned to each of several output ports of the computer. The output port decoding logic will determine when the latch is addressed for output. The result of decoding is a WRITE signal which latches the data presented at the bus receivers. The sample program of figure 2 assumes two such display registers. In principle the idea can be extended to many registers in groups of eight, limited only by the computer's input output addressing capability and the available power for lighting LEDs. In this circuit, TTL fanout limitations on the bus receivers would limit expansion to a total of 10 latches. The LEDs can be mounted on a separate display panel with connections by means of dual in line header plugs and sockets. A neutral tinted glass or plastic cover plate and an attractive wooden frame are good finishing touches for the visible portion of the project.

Figure 2: The CATERPILLAR program listing. Opcodes and addresses are specified in octal notation for the 8008 CPU. Comments at the right are designed to help convert the program to other machines.

```
address   octal code  label    op.   operand     commentary

010/000   250          START    XRA                clear carry and A;
010/001   036 377               LDI   11111111B   first caterpillar word;
010/003   046 000               LEI   00000000B   second caterpillar word;
010/005   304          MARCH    LAE                right byte to A;
010/006   022                   RAL                shift left into carry;
010/007   340                   LEA                then saved for next time;
010/010   303                   LAD                left byte to A;
010/011   022                   RAL                shift left into carry;
010/012   330                   LDA                then saved for next time;
                     *   note that RAL shifts old carry into A each time,
                     *     thus the above accomplishes shift from E's high
                     *     order bit into D's low order bit via carry...;
010/013   177                   OUT   37           write into left lamps;
010/014   304                   LAE                fetch right value;
010/015   175                   OUT   36           write into right lamps;
010/016   026 300               LCI   192D         set delay loop constant;
010/020   307          DELAY    LAM                use
010/021   307                   LAM                  several
010/022   307                   LAM                    longish
010/023   307                   LAM                      instructions
010/024   307                   LAM                        to
010/025   307                   LAM                      s t r e t c h
010/026   307                   LAM                    out
010/027   307                   LAM                  the
010/030   307                   LAM                loop
010/031   307                   LAM                (a BYTE in time saves nine);
010/032   021                   DCC                decrement delay count;
010/033   110 020 010           JFZ   DELAY        if non zero then repeat delay;
010/036   104 005 010           JMP   MARCH        back for another step;
                     *   note that during the operations at addresses 010/013
                     *     to 010/036 the carry bit value set by the last RAL
                     *     is retained unchanged, so that the RAL at 010/006
                     *     will shift the old high order bit of the left register
                     *     (D) into the low order bit of the right register (E);
```

This program uses only the internal CPU registers for its data, and assumes that 8008 output ports 36 and 37 are assigned to latched 8 bit displays so that a visible pattern can be seen.

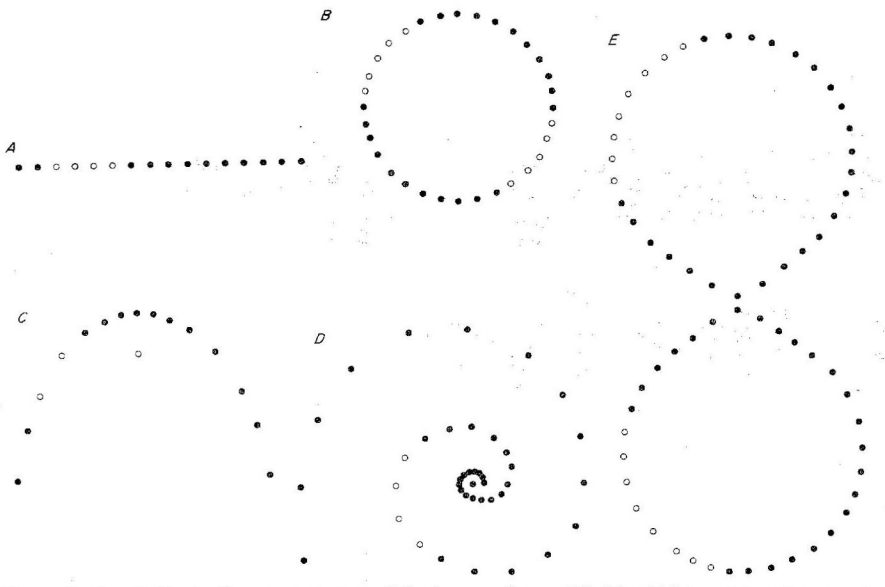


Figure 3: Creativity in the arrangement of the lamps of your blinking light peripheral can make the show more impressive and interesting. A: The traditional blinking light display, a la control panel, is a straight line of sixteen lamps in a row using two output latches. B: Tradition is nice, but how about a bit of circular thinking, using thirty two lamps in a circle with four output latches. C: Don't rule out the bouncing ball effect either. Here we make a parabola shape using sixteen lamps, one at the focus, with two output latches. D: With enough lamps, we can make a spiral show with one or more arms. Here are forty lamps using five output latches. E: There are an infinite number of patterns to be made. In this case, infinity consists of sixty four lamps using 8 output latches.

light pattern function for 16 bits? The basic way in which this is accomplished is to shift the bits through the carry flag of your machine.

Figure 2 illustrates a program which does a 16 bit shift in an 8008 microcomputer, and sends the data to the output ports reached by the OUT36 and OUT37 instructions (octal 175 and 177, respectively). The result is a moving display of 16 lights. A band of several bits is always marching right to left around the display at a steady rate.

But, why let the imagination end at a mere 16 bit display? The use of IO ports can be extended without too much cost (given limitations on power supplies, of course). The cost of two 7475s, eight resistors, and eight LEDs is about $3 (using BYTE's advertising pages as a source of prices). Thus a very reasonable display of 64 LEDs will set you back only $24 and the time it takes to put it together.

Using a bit of imagination, the extension of the program can lead to interesting patterns running around non-linear configurations such as those illustrated in figure 3. Variations in the patterns result in displays of light. Beyond the scope of this short article are more complicated programs using the same display peripheral: Programs in which the light patterns do more interesting things than simply chasing around the racetrack at uniform speeds.

Try building a simple 16 bit blinking light display version first, then go on to bigger and better things. Then see if you don't agree that there's more to BLINKing lights than meets the eye! ■

Reprinted from *BYTE Magazine,* January 1976.

JIM GEROW WINS SOFTWARE CONTEST AGAIN

by Bill Gates

Another fourteen programs were added to the library this month, and I think a lot of Altair users will find them useful.

Jim Gerow, whose FORTRAN cross-assembler #521751 has been the most requested program in the library, has sent in a FORTRAN simulator for the 8800 (#1123751) which is the winning major program this month. When a file is assembled by the cross-assembler there is an option to output the assembled code as a file that the simulator can read and execute. The simulator allows the user to set breakpoints, dump the registers, dump memory contents, change the registers and change memory contents.

The second place major program is S. Armstrong's tape labeling program (#117751). This program is very useful for users who have lots of paper tapes.

The third place major program is Jerry Ford's JAMON (#117752). Commands are provided which make it unnecessary to use the front panel switches.

The winning subroutine is George Rompot's GET routine (#1117751). This program is especially notable for its good documentation. Unlike Mr. Rompot, most Altair users haven't programmed for very long. A hard-learned lesson about programming is that good documentation is not just an aesthetic, but is indispensable. It forces a programmer to be aware of what subroutines he has embedded in his program, what calling sequences should be used and explains the assumptions and techniques used in each section of code.

The second place subroutine is Jack Coats' BCD multiply routine (#113751). BCD multiplication is more complicated than binary multiplication. For people who like numbers with hundreds of digits and understand BCD (or want to), this routine can be set up for up to 512 digits per number without much trouble.

Software Library

#1020751
Author: Gerhald Hansel
Length: 46 lines of Basic
Title: Addition problems
Produces a group of math addition problems and answers. Written to use PRINT USING, a feature of Extended Basic, to format its output.

#1020752
Author: Lee Eastburn
Length: 290 locations
Title: Print program
Dumps a program with page headings, an address field and the octal contents of the address. Columns are provided to fill in labels, instruction mnemonics and comments.

#1121751
Author: Gary Tack
Length: 152 bytes
Title: Random Magic Squares
Generates 3 numbers which are used to make a magic square (a 3x3 grid in which the sums of the numbers in each row, column and diagonal are equal). All "magic squares" can be generated since 3 numbers characterize a magic square. Each group of 3 numbers generates a distinct magic square. Stores magic square information in memory. Doesn't do any input/output.

#1117751
Author: George Rompot
Length: 41 bytes
Title: GET - a "Lifeline" subroutine
A well-documented subroutine to perform the functions of the TGET and LGET subroutines specified in the lifeline article in Byte magazine. (October 1975, pp. 34-41) Includes test routine.

#1117752
Author: George Rompot
Length: 25 bytes
Title: CHECK
A well-documented subroutine to calculate a 16-bit sum of an area of core specified in the calling parameters. Optionally checks the computed checksum with a checksum provided in the calling sequence. A testing program is included.

#117751
Author: S. Armstrong
Length: 124 instruction bytes (not including embedded NOPS)
342 data bytes
Title: Punch tape label
Punches paper tape labels by using 5 tape frames to make a block letter. Can "print" any alphabetic, numeric, or common delimeter. Additional characters can easily be added. "Prints" an entire line at once with separating blanks.

#117752
Author: Jerry Ford
Length: 318 bytes
Title: JAMON - a teletype monitor
This monitor allows examining (dumping) of memory blocks, depositing into memory blocks and jumping to a specified address. All inputs and outputs are in octal. Subroutines for character input, character output, octal input and octal output are included.

#113751
Author: Jack Coats
Length: 83 bytes
Title: BCD multiplication subroutine
Currently set up to multiply two 8-digit numbers in memory and give a 16-digit number in memory for a result. Can be changed for different size numbers without much difficulty.

#1030752
Author: John Trautschold
Length: 16 bytes
Title: VLCT load program
Allows entry of a load address and program data in octal from a VLCT keyboard. The entered data is displayed for verification. Documented with high 8-bits of start address as "XXX" so the program can easily be located at the start of any memory page (a block of 256 consecutive memory locations, the first location of which has an address divisible by 256 [decimal]).

#1030751
Author: Lee Eastburn
Length: LOAD section-71 bytes
DUMP section-96 bytes
Title: ASCII Octal Loader and Dumper
The DUMP section outputs the contents of a block of memory in ASCII octal (3 characters ["Ø" - "7"] for each byte). Twenty bytes are printed on each line of output. The LOAD section loads a tape of the same format, ignoring all characters except "Ø" through "7." The start and end locations are specified by changing LXIs in the programs themselves.

#1021751
Author: Jack Coats Jr.
Length: 46 bytes
Title: A Dual-Tasker
An interrupt level routine to switch between two tasks. Context is saved on the stack and the stack pointer is saved in memory.

#1027751
Author: Jack Coats
Length: 43 bytes
Title: Time of Day routine
Using the real-time-clock interrupts this program keeps track of the hours, minutes, seconds and hundredths of seconds that elapse. The data is stored in binary coded decimal.

#1027752
Author: Roger J. Walker
Length: 53 bytes
Title: TVTDR-I/O handler for TVT-II
TVTDR is designed to overcome a deficiency in the TVT-II that prevents it from blanking to the end of the line when a carriage return is output. The appropriate number of spaces are output instead of a carriage return. Instruction for interfacing to Altair Basic are given.

#1123751
Author: Jim Gerow
Length: 33 pages
Title: A FORTRAN simulator for the 8080
A FORTRAN program to take as input the code generated by Mr. Gerow's Cross Assembler (#521751) and simulate the Altair's execution of the code. Extremely useful for debugging. A manual is included with the source listing. A list of changes to be made to cross assemblers received before December 1, 1975 to allow them to work with the simulator are given.

SOFTWARE

The Status of BASIC

by Bill Gates

Some of the more persistent and expert users of Basic have noted a few bugs in some of the versions of Altair Basic.

SPR (Software Performance Report) #1-
CSAVE sees only three zeros.
Symptoms: Some CSAVEd files will not CLOAD. Happens infrequently.
Found by Bill Gates and later noted by Steve Grumette and J. Scott Williams.
Present in: 3.0 and 3.1 cassette of 8K.

Change: Made in 3.2. In 3.1 8K cassette if 10075 base 8 (4157 decimal) contains a 6, change the location after this (10076) from 4 to 3 (POKE 4158,3). If 10075 doesn't contain a 6 and 10076 (4158) contains a 6, change the next location (10077) from 4 to 3 (POKE 4159,3).
Files CSAVEd before the fix will CLOAD properly after the fix.

SPR #2-
Unreferenced non-array variables.
Symptoms: Assigning an array element the value of a formula containing a non-array variable which has never been referenced before is done improperly. A correct program will never do this. Found by Steve Grumette.
Present in: 3.1's and 3.0 4K
Change: Made in 3.2.

SPR #3-
String compare.
Symptoms: The string comparisons: A$>B$, A$>=B$ and A$<>B$ return zero if A$ is an extension of B$. That is, B$=LEFT$(A$, LEN(B$)) and Len (A$)>Len (B$). Found by Steve Grummette.
Present in: 3.0 and 3.1 8K's.
Change: Made in 3.2. Decimal numbers in []. Patch for 3.1 8K cassette:

[2778] 5332/ from 267 [183] to 326 [214]
[2779] 5333/ from 57 [47] to 1 [1]
[2780] 5334/ from 310 [200] to 330 [216]

Patch for 8K 3.1 paper tape:

[2765] 5315/ from 267 to 326
[2766] 5316/ from 57 to 1
[2767] 5317/ from 310 to 330

For a piece of software that's been running for 9 months, with over a thousand copies in use and 9 different versions, it's pretty respectable to have had only five bugs--none of them serious. (2.0 wasted stack space when "FOR" loops terminated and handled non-square matrices with more than one dimension improperly.)

Beware of using a loop variable, first in an outer loop that never completes and then in an inner loop. Example:

```
1Ø  FOR I = 1 to 1Ø
2Ø  IF Y(I) = 7 THEN 4Ø
3Ø  NEXT I:  PRINT "ERROR":STOP
4Ø  FOR J = 1 to 13
5Ø  FOR I = 1 to 5
    .
    :
6Ø  NEXT I
7Ø  NEXT J
```

When a "FOR" statement is executed, a check is made to see if any uncompleted loops use the same loop variable as the "FOR" which is just starting. If so, the original loop and any started after it are automatically terminated. Therefore in this example, the execution of line 5Ø would terminate the loops started in lines 1Ø and 4Ø.

Users wishing to modify the way Basic does I/O to the terminal should use a machine language program or the PEEK function to find the four different locations where terminal I/O is affected:

```
#1 OUTPUT:  IN   Ø
            ANI <mask for output ready>
            JZ or JNZ to the IN Ø
            POP  PSW
            OUT  1
            RET

#2 INPUT:   IN   Ø
            ANI <mask>
            JZ or JNZ back to the IN Ø
            IN   1

#3 CONTROL-C check:
            IN   Ø
            ANI <mask>
            RNZ or RZ
            CALL D

#4 (not in 4K) High Speed Control-C
               check:
            IN   Ø
            ANI <mask>
            CZ or CNZ
```

The addresses of these four code sequences varies from BASIC to BASIC.

Two special options are available in BASIC for $15.00 each. (NOTE: Cassette files will only CLOAD in a BASIC with the same special options as the BASIC that CSAVEd the file.) One option adds a CONSOLE command that allows a user to change the terminal he is using with a single command. The other option adds LLIST and LPRINT which are the same as LIST and PRINT, except their output goes to the line printer. Patches are not given for BASICs with special options.

Besides the changes already mentioned, 8K BASIC 3.2 will have two other enhancements:

1) Numbers less than .1 and greater than or equal to .01 will print as .0XXXXXX (trailing zeros suppressed) instead of X.XXXXXE-2.

2) Cassette versions will allow for verification that a CSAVEd file is recorded properly. Giving the command CLOAD? <file-character> will search for the named file and compare it to the program in memory typing "NO GOOD" if they are different. Suggested by J. Scott Williams.

Note that numbers that print the same are not always equal. This is because the seventh digit of accuracy that BASIC stores is never printed. Use of the intrinsic functions or exponentiation can cause an error of ±1 in the seventh digit.
Example: (from Dick Heiser)

```
1Ø  X = 5↑2
2Ø  PRINT X
3Ø  IF X<>25 then PRINT "NOT EQUAL"
RUN
 25
NOT EQUAL
OK
```

This calculation of 5↑2 gives 25.00001 which does not equal 25, but which prints like 25. STR$(X) = STR$(25) would work as a check for two numbers being very close.

The Random Number generator is not as pseudo-random as it should be (first noted by Dick Heiser), and new algorithms are being examined to improve it.

A lot of people ask if there is any problem using lower case letters with BASIC. As long as the reserved words and variable names are entered in upper case, there is no problem. Remember, though, "Z"<"a".

If anyone is using BASIC version 1.1, you have a copy of a tape that was stolen back in March. No customers were ever shipped 1.1, as it was experimental and is full of bugs!

If anyone is using 2.Ø, I encourage them to upgrade to 3.2, mainly because Version 3 BASICs are so much faster than Version 2.

As for Extended BASIC, the non-disk version was completed a few weeks ago and should be completely documented and out the door by the time this is published. Paul Allen demonstrated Extended BASIC in Denver a few weeks ago, and Denver's top hacks couldn't find any bugs. I think a lot of people will really like the "EDIT" command that's been added.

Software Notes

by Bill Gates

To go with the decimal output routine given in September's issue, here is a decimal input routine. For fun, modify it so it checks for overflow. (Hint: use the carry bit generated by DAD.)

```
;routine to do decimal input (DECINP)
;return result in [H,L]. [A] contains the terminating character.
;[D,E] is smashed. Stack use: INCHR is called to get a character
;in [A]. Overflow is not checked.

DECINP:     LXI    H,Ø          ;initialize to zero
DECLOP:     CALL   INCHR        ;read a character into [A]
            CPI    "9" + 1      ;see if it is > "9"
            RNC                 ;return if so
            CPI    "Ø"          ;see if it is < "Ø"
            RC                  ;return if so
            SUI    "Ø"          ;[A] = numeric value of new digit
           †MOV    D,H          ;[D,E] = [H,L]
           †MOV    E,L
            DAD    H            ;[H,L] = old [H,L]*2
            DAD    H            ;[H,L] = old [H,L]*4
           †DAD    D            ;[H,L] = old [H,L]*5
            DAD    H            ;[H,L] = old [H,L]*1Ø
            MVI    D,Ø          ;[D,E] = new digit
            MOV    E,A
            DAD    D            ;add in the new digit
            JMP    DECLOP       ;get more digits
```

†eliminate for octal input

The simplicity of loading BASIC into an Altair is important, since people without PROMs or BASIC on ROM must load it every time they power up their machine. Here are the details of how this process works:
(All numbers are octal)

The format of a binary tape of BASIC or a monitor is as follows:

```
leader = 175 currently
last byte of checksum loader (311)
next to last byte of checksum loader (172)
  .
  .   intermediate checksum loader bytes
  .

second byte of checksum loader (61)
first byte of checksum loader (363)
gap of null characters (0)
<checksum data block -- up to 256
 data bytes per block>
<additional checksum data blocks
 until all program data has been given>
<checksum go block>
```

Checksum loaders can be loaded into most pages of memory depending on location 2 of the boot and which checksum loader is on the tape. The checksum loader for 4K BASIC and the Package I monitor starts at location 7400. The checksum loader for 8K BASIC starts at 17400. Except for being relocated, these loaders are identical.

Checksum data block:

```
74 start character
number of data bytes in the block (Ø=256)
lower 8 bits of storage address
high 8 bits
<data bytes>
checksum byte = summation without carry of all bytes
                in the block except the 170 and count
                specification
```

— CONTINUED PAGE 21 —

Notes on Disk Extended BASIC

Disk Extended BASIC is a stand-alone system which is delivered on a floppy disk. This floppy has been formatted and loaded with the utility files that print directories, format other disks and do disk diagnostics as well as Extended BASIC. The disk loader is about 100 bytes and can either reside on a PROM, be keyed in or be loaded from ACR or paper tape using the standard 20-byte bootstrap.

During initialization the number of disk buffers (maximum 8) and random access blocks (maximum 8) to be allocated are determined by the user. These numbers determine the number of files that can be open simultaneously and the number of random access files that can be open simultaneously, respectively. The disk drives that are to be brought on line are all checked for proper formatting and the locations of free sectors are stored in memory.

Each floppy can store 300,000 bytes (characters) of user information. The rest of the storage space on the floppy is used to store the file structuring and error detection information. Up to 254 files can be stored on a floppy and a single file can be up to 300,000 bytes long. A file must reside entirely on a single floppy, thus no file can be larger than 300,000 characters.

There are three modes for file access:
1) Sequential input: The file is stored as ASCII text. Numbers and strings are read as character strings in exactly the order they were typed in or written out.

2) Sequential output: Any previous contents of the file are deleted and output is done item by item in ASCII.

3) Random access: Each record is 128 characters. Numbers are written in binary, so integers take 2 bytes, single-precision numbers 4 bytes and double-precision numbers 8 bytes. Special functions return the record number of the current position in the file (LOC) and the highest numbered record currently allocated (LOF) in the file. READs and PRINTS of random access records can be intermixed. A specific record number in the file can be specified by a formula in both the READ and PRINT statements.

All the features of non-disk Extended BASIC are provided. The current expected delivery date for Disk Extended BASIC is January 1, 1976. To use Disk Extended BASIC, 16K of memory is required since the program itself uses 12.5K and each disk buffer and random access block require another 140 bytes.

end

Checksum: go block

170 start character
lower 8 bits of address to jump to
high 8 bits

The data block for locations Ø through 376 is the last data block on the tape so the bootstrap loader doesn't have to be keyed in again when checksum errors occur, unless the checksum error is on the final data block.

BOOT STRAP LOADER
start at location zero

```
0/      LXI   H,
        number of bytes in the checksum loader
        page number of the checksum loader

                      Set [H,L] to point to the last location
                      in the checksum loader + 1.

3/      LXI   SP,STKADR   Set [SP] so returns come back to this
                          location.  After each return [SP] is reset.

6/      IN    Ø           See if there is a character, and loop
        RAR               if not.
        RC

12/     IN    1           Read a character and see if it's leader.
        CMP   L           (Lead character = number of bytes in the
        RZ                checksum loader)

16/     DCR   L           Store the data in the next lower location,
        MOV   M,A         and loop unless all bytes have been read.
        RNZ

21/     PCH   L           Start the checksum loader at its beginning.

22/     STKADR:  DW LOPADR
                      The stack pointer points here, so this
                      gives the address returns branch to.
```

This bootstrap loader has several advantages:

1) Leader is allowed.
2) Only 20 bytes need to be keyed in.
3) It automatically starts the checksum loader, so only one tape needs to be entered.
4) It can run from Read Only Memory.
5) It starts at a convenient location (zero).
6) It is easily relocated by changing the addresses at locations 4 and 22.
7) To load different checksum loaders, only location 2 needs to be changed.

I've written a bootloader that only takes 13 bytes of keyed-in data, but anything smaller than 20 bytes isn't easy to use.

Next Month: Signed and unsigned arithmetic
Multiprecision arithmetic

Letters to the Editor

CONTINUED FROM PAGE 10

2. The modification proposed for the 4K memory card converts the protect input circuit from a toggle input to a type D flip flop. It won't hurt anything, but all it eliminates is the need to occasionally press protect more than once. A better design for the protect flip flop in the 4K memory card would have been a type D circuit. However, it is hardly a major issue, and the cure is worse than the problem.

3. The proposed change to C-7 will decrease the timing margins and should not be made.

4. A complete discussion of the ready line appears in Ed Roberts column in this issue.

If you hear of some mod or change to the system, please write or call us before you install it. Any modification that we believe is useful, reliable and doesn't damage the system will appear in this publication.
--DB

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(In a previous issue, there was an error in printing Mark's address. He lives in Bowie, Maryland--not Missouri)

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1676 Ala Moana Blvd.
Apt. 307
Honolulu, HI 96815

ALTAIR DEALERS

The following is a list of Altair dealers. Most Altair kits should be in stock at these outlet stores.

Arrowhead Computer Co.
(The Computer Store)
11656 W. Pico Blvd.
Los Angeles, CA 90064
Lois & Dick Heiser
(213) 478-3168

Byte'Tronics
5604 Kingston Pike
Knoxville, TN 37919
Bruce Seals
(615) 588-8971

The Computer Center
3330 Piedmont Road
Atlanta, GA 30305
Jim Dunion, Rich Stafford
Steven Mann, Ron Roberts
(404) 231-1691

Computer Kits
1044 University Ave.
Berkeley, CA 94710
Pete Roberts
(415) 845-5300

Computers & Stuff
1092 S. State St.
Orem, UT 84057
Eric & Debra Stewart
(801) 224-2066

Gateway Electronics
2839 W. 44th Ave.
Denver, CO 80211
George Mensik
(303) 458-5444

Gateway Electronics
8123-25 Page Blvd.
St. Louis, MO 63130
Alfred L. Elkins (Lou)
Stuart Bartfield
(314) 427-6116

Marsh Data Systems
Suite 120, 1805 N. Westshare
Tampa, FL 33607
Don Marsh
(813) 872-7334

Microsystems
6605A Backlick Rd.
Springfield, VA 22150
(Washington DC area)
Russell Banks
(703) 569-1110

CTI Data Systems
3450 East Spring St.
Long Beach, CA 90806
Fred Whitney
(213) 426-7375

Byte Shop
1063 El Camino Real
Mountain View, CA 94043
Boyd W. Wilson, Paul Terrill

Ridgway East, Inc.
161 Bell St.
Chagrin Falls, OH 44022
(Cleveland)
Ray Wassum, Jack Stevens

The Computer, Inc.
PO Box 2621
Framingham Center, MA 01701
Richard F. Brown
(617) 877-6984

I/O Programs for the ACR

Input/Output programs for the 88-ACR

By Tom Durston

One request we've been getting frequently is for simple machine language programs to write and read data on tape through the 88-ACR. Listed below is a program to write and a program to read using the 88-ACR. These programs have been used in our engineering department to store lengthy test routines, and can be used for any type of data.

WRITE PROGRAM - 38 bytes

Writing data on tape through the 88-ACR is accomplished by first specifying the start address of data and the end address of data. Then a test byte (000 in this program) is written, followed by data output. The last portion of the program tests to see if the program has transmitted the last byte of data. If it has, the program jumps to the last positions in memory, and is observed by a change in the address lights on the front panel. If the program hasn't outputted the last data byte, the H & L registers are incremented by 1 and the program outputs the next byte. This program is placed in the upper portion of 4K memory with a starting address of 017,000. The location may be changed, but be sure to change all jump addresses accordingly. After recording data that includes program information, write down the start and end address on the tape cartridge along with the name and test byte of the program for identification.

When recording data at the beginning of a cassette tape, record at least 15 seconds of steady tone before running the write program (to get past the plastic leader and wrinkles in the beginning of the tape). Also, if recording more than one batch of data, leave at least 5 seconds of steady tone between batches. This program is written for 88-ACR addresses of 6 & 7.

88-ACR WRITE PROGRAM

TAG	MNEMONIC	ADDRESS	OCTAL CODE	EXPLANATION
	LXI	017,000	041	Load immediate H&L register pair
		1	xxx	Lo } starting address of
		2	xxx	Hi } data to be written
	LXI	3	001	Load immediate B&C register pair
		4	xxx	Lo } end address of
		5	xxx	Hi } data to be written
	MVI	6	076	Move immediate to accumulator
		7	000	Test byte to be written at beginning
	OUT	017,010	323	Output data from accumulator
		11	007	Data channel # of 88-ACR
TEST	IN	12	333	Input data to accumulator
		13	006	Status channel # of 88-ACR
	RLC	14	007	Rotate accumulator left, test for D7 true
	JC	15	332	Jump if carry (D7 not true)
		16	012	} To "TEST"
		17	017	} To "TEST"
	MOV	017,020	176	Move contents of memory specified by H&L register to accumulator
	OUT	21	323	Output data from accumulator
		22	007	Data channel # of 88-ACR
	MOV	23	175	Move contents of L register to accumulator
	CMP	24	271	Compare accumulator vs B register
	JNZ	25	302	Jump if not zero (L ≠ B)
		26	040	} To "NEXT"
		27	017	} To "NEXT"
	MOV	017,030	174	Move contents of H register to accumulator
	CMP	31	270	Compare accumulator vs C register
	JNZ	32	302	Jump if not zero (H ≠ C)
		33	040	} To "NEXT"
		34	017	} To "NEXT"
	JMP	35	303	Jump (if L = B and H = C)
		36	375	} To "END"
		37	017	} To "END"
NEXT	INX	017,040	043	Increment register pair H&L
	JMP	1	303	Jump
		2	012	} To "TEST"
		3	017	} To "TEST"
END	JMP	017,375	303	Jump (loop to self)
		376	375	} To "END"
		377	017	} To "END"

CONTINUED FROM PAGE 22

I/O Programs for the ACR

READ PROGRAM - 48 bytes

As in the write program, start and end addresses of incoming data are specified first. Next, the program looks for the test byte (000 in this program). Once the test byte is detected, the program inputs data and stores it in memory as specified by the H & L registers. The next portion of the program tests to see if the end memory address has been filled. If it has, the program jumps to the last positions in memory, and is observed by a change in the address lights on the front panel. If it is not the end, then the program increments H & L by 1 and jumps back to input another data byte. This program is placed in the upper portion of 4K of memory with a starting address of 017,000. The location may be changed, but be sure to change all jump addresses accordingly. When reading data back in, the tape and program should be started a few seconds before the start of data.

88-ACR READ PROGRAM

TAG	MNEMONIC	ADDRESS	OCTAL CODE	EXPLANATION
	LXI	017,000	041	Load immediate H&L register pair
		1	xxx	Lo } starting address of
		2	xxx	Hi } data to be read
	LXI	3	001	Load immediate B&C register pair
		4	xxx	Lo } end address of
		5	xxx	Hi } data to be read
TSTBT	IN	6	333	Input data to accumulator
		7	006	Status channel # of 88-ACR
	RRC	017,010	017	Rotate accumulator right (test DØ true)
	JC	11	332	Jump if carry (DØ not true)
		12	006	} To "TSTBT"
		13	017	
	IN	14	333	Input data to accumulator
		15	007	Data channel # of 88-ACR
	CPI	16	376	Compare immediate with test byte vs accumulator
		17	000	Test byte
	JNZ	017,020	302	Jump if not zero (test byte≠input byte)
		21	006	} To "TSTBT"
		22	017	
TEST	IN	23	333	Input data to accumulator
		24	006	Status channel # of 88-ACR
	RRC	25	017	Rotate accumulator right (test DØ true)
	JC	26	332	Jump if carry (DØ not true)
		27	023	} To "TEST"
		017,030	017	
DATA	IN	31	333	Input data to accumulator
		32	007	Data channel # of 88-ACR
	MOV	33	167	Move contents of accumulator to memory address specified by H&L registers
	MOV	34	175	Move contents of L register to accumulator
	CMP	35	271	Compare accumulator vs B register
	JNZ	36	302	Jump if not zero (L ≠ B)
		37	051	} To "NEXT"
		017,040	017	
	MOV	41	174	Move contents of H register to accumulator
	CMP	42	270	Compare accumulator vs C register
	JNZ	43	302	Jump if not zero (H ≠ C)
		44	051	} To "NEXT"
		45	017	
	JMP	46	303	Jump (if L = B and H = C)
		47	375	} To "END"
		017,050	017	
NEXT	INX	51	043	Increment H&L register pair
	JMP	52	303	Jump
		53	023	} To "TEST"
		54	017	
END	JMP	017,375	303	Jump (loop to self)
		376	375	} To "END"
		377	017	

Notebook

4K PROTECT

Hitting the protect switch will occasionally not protect the 4K dynamic memory board. This problem is alleviated by removing pin 10 of IC"T" from +5V and jumpering it to ground instead. Ground is available on pin 11 of IC"T".

SIOB & ACR OWNERS

Before inserting IC"G" on the SIOB, TTL interface, check for a copper land between pins 2 and 3. If there is one, remove it, or you will get the following symptoms: you cannot enter a 1 (HI LEVEL) in bits 2, 3, 4, or 7 (of Ø-7) except at the memory address which corresponds to the address of the I/O board.

contributed by Edwin F. Hanpton

MISPRINT

October 1975 Computer Notes, page 9: USING SERIAL BOARDS
Echo Program Step 17
reads 012
should read 013
Interrupt Program Step 11
reads 011
should read 010

Seminar Tours

Schedules for the next MITS-MOBILE tours are now being planned. Exact dates cannot be announced, as we do not yet have confirmation of the availability of meeting rooms at all locations.

The tentative itinerary for the last three weeks of February includes stops in Lubbock, Ft. Worth, Dallas, Houston, Corpus Christi, San Antonio, Austin, Odessa, and El Paso--all in that huge state of Texas. Also Tucson and Phoenix, Arizona.

From mid-March to mid-April we plan to be on the west coast--including San Diego, Los Angeles areas, Fresno, San Francisco Bay area, Sacramento, Portland, and Seattle.

The general format of these lectures will continue to aim at bringing information of interest to individuals with varying levels of experience.

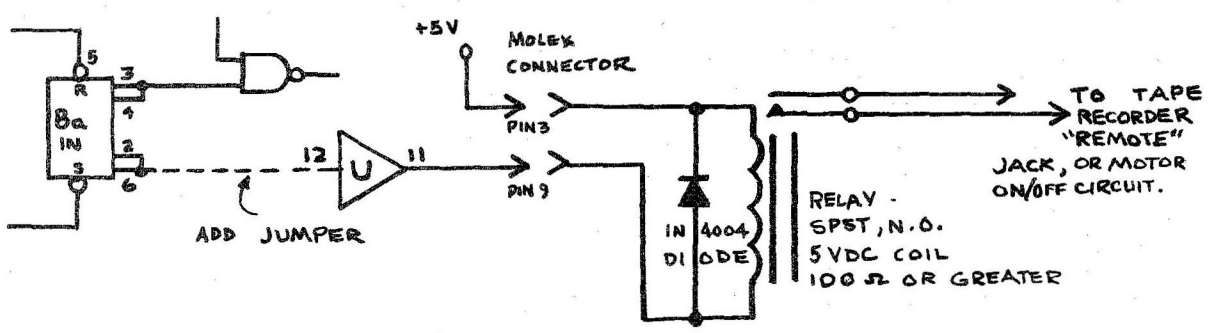
Upgrading plans for our seminars includes: more material in the course manual, more emphasis on I/O devices, more equipment demonstrations including several new MITS products.

...more notes on ACR

Tape Recorder Motor Control

Another request for the 88-ACR has been for start/stop motor control for DC motor tape recorders with the subminiature phone jack marked "REMOTE." A simple way to do this is to utilize an unused flip-flop normally intended for the interrupt function on the 88-SIOB board. Since the interrupt circuit is usually not used in the 88-ACR mode, it is possible to connect the output of one of the flip-flops to an unused driver of an 8T97, using it as a relay driver.

The circuit shown below uses control channel bit DØ to turn the motor on and off. Consult page 3 of the 88-SIOB manual and the 88-SIOB schematic for detailed information on this circuit.



The other half of IC B may be used for another control function in the same manner. IC U has 3 other spare drivers that may be used.

We suggest the relay be mounted externally to prevent recorder supply voltages from interfering with the Altair 8800.

For the machine language Read/Write programs, adding the following instructions will allow use of the start/stop feature.

To turn the motor circuit on, place these instructions before the beginning of the Write and Read programs.

Location	Octal Code	Mnemonic/Description
016,374	076	MVI move immediate to accum.
375	001	Turn on motor
376	323	Output data from accum.
377	006	Control channel

NOTE: For Write program, single step through these 4 instructions, wait appropriate time (5-15 seconds), then hit RUN.

To turn the motor off, place these instructions before the jump to self loop at "END." Also change data in location 017,376 to 371.

Location	Octal Code	Mnemonic/Description
017,371	076	MVI
372	000	turn motor off
373	323	Output
374	006	Control channel

NOTE: The flip-flops Ba and Bb do not have power on clear. It may be necessary to single step the motor off circuit to clear these flip-flops.

For use with Altair 8K BASIC, use:
OUT 6,1 - to turn motor on
CLOAD or CSAVE
OUT 6,0 - to turn motor off

Keep in mind that if writing, you must turn the motor on 5-15 seconds before outputting data.

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OR 262-1951

CLASSIFIED ADS

WANTED: Name & address for owner of 8800 serial number 222755K. Information was missing from warranty card mailed from Dayton, Ohio.

WANTED: Name & address for owner of 8800 serial number 221128A. Information was missing from warranty card mailed from Los Angeles.

WANTED: Software developer with IBM equipment who will convert EBDICT to ASCII on a one shot basis. Contact Jim Leek, Bakersfield Audio, 2801 F Street, Bakersfield, CA 93301

WANTED: FORTRAN to run on the Intel 8080 CPU based systems. Anyone with information on this please contact Jack O. Coats, Jr., El Paso Computer Group, 213 Argonaut #27, El Paso, TX 79912

FOR SALE OR TRADE: Techtronics 4602 video hard copy unit. Produces 8 1/2x11 prints from standard video (i.e. video terminal). Contact Mark Bunker/2703 S. 71st Pl./Kansas City, KS 66106 913-375-1138

FOR SALE: 10 CPS EIS impact printing terminal. Standard RS-232C data in and out. Close equivalent of TTY model 33KSR. Good shape. $230 FOB Denver. M. Smith/4355 S. High St./ Englewood, CO 80110

Is anyone working on inventory control & bookkeeping packages in BASIC (extended)? If so, please contact Eugene Zander/O'Keefe Supply Co./ 613 Williamson St./Madison, WI 53703

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"Handy Dandy" paper tape winder. Uses 4 D batteries (not included). $15.00 plus $1.00 postage & handling. Bill Roch, 5133 Catalon Ave., Woodland Hills, CA 91364

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